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KRAUSZ'S

A B C OF MOTORING

A VANDERBILT CUP RACER

KRAUSZ'S

A B C OF MOTORING

A Manual of Practical Information for Layman, Auto Novice and Motorist

CONTAINING

Dictionary of Terms, Types of Cars, Anatomy of the Automobile, Motors, Carbureter, Ignition, Cooling, Tires, Transmission, etc. Care of the Machine, Art of Driving, Troubles of the Road, Etiquette of Automobiling, Racing Rules and Statistics, Foreign Travel, Clubs, Manufacturers, Trade Papers, Speed Tables, and

COMPLETE DIGEST OF

MOTORING LAWS OF THIRTY-FIVE STATES

AND NAMES OF THOSE HAVING NO LAWS

BY

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Author of "Krausz's Complete Automobile Record," etc.

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AUTHOR'S PREFACE

In adding the present volume of "Krausz's A. B. C. of Motoring" to the ever-growing library of automobile books, it is my thorough belief that I am supplying a work which will prove a special boon to the layman and novice who . to acquire the first rudiments of automobile knowledge, and at the same time be of practical use to technically experienced motorists. The first, I am sure, will find its principal advantage in the condensed and simple form of the technical chapters, which are given in the plainest possible language, while the latter, who are supposed to thoroughly know the anatomy of the motor car, will find among the contents a plethora of miscellaneous information which, elsewhere, can be found only scattered in a multitude of publications that are not always at hand, and to look for which means an expenditure of time and effort.

The impetus to write the "A. B. C. of Motoring" has been given me by the vain search for an elementary book on automobilism at the time when I first entered the ranks of motorists and could find

nothing but works that may be of use to engineers and motor experts, but are too scientific, too voluminous, and written in terms too bewildering to the average layman and beginner to take the place of a first automobile reader. While many of these works are of much value after preliminary experience has been gained, they certainly cannot serve as initiatory steps to higher knowledge for men to whom the first principles of motoring and the mechanism of a car are as much of an enigma as the sphinx.

With my own experience as a basis, I have started out, therefore, to fill in a hiatus in automobile literature, and a glance at the table of contents will convince the reader that I have tried to cover as much ground as is practical in a work of this nature. Whether my effort in the direction indicated has been a success, only a perusal of the contents can prove. For the sake of the reader and myself I earnestly hope so.

THE AUTHOR.

Chicago, October, 1906.

INTRODUCTION

Before accepting the author's invitation to write a few introductory lines to his work, I have, naturally, perused the chapters relating to the technical part of the book, as well as the other information contained therein. Having done this, I desire to say that I have found "Krausz's A. B. C. of Motoring" to be exactly what may be inferred from its title: i. e. short, practical teaching for the man who wishes to acquire the rudiments of motoring in a way which does not necessitate previous technical knowledge or even familiarity with technical terms. In fact, it is written in popular language, such as the merest auto novice is bound to understand, and therein lies its advantage over other books of a similar nature.

The author does not pretend to write for engineers and motor experts, or to give complete instruction in automobile technics, but he tells the beginner all about the evolution of the motor car, its modern types with their advantages and disadvantages, how to handle and take care of an automobile, and he explains

the functions of the various parts of the mechanism in plain language without the technical frills which most writers on similar subjects affect.

The statistical and other information which the book contains will no doubt be much appreciated by motorists in general as it has been compiled with a view of collecting in one volume matter of vital interest, to get at which automobile annuals, trade papers and other publications would have to be consulted.

It seems to me, therefore, that this work ought to be valuable as a first step to further automobile knowledge, since it puts the novice on the right track in the preliminary information necessary before further advancing in the science of motoring. The book is a pleasant contrast to the pretentious volumes on the market which may appeal to experts and advanced students of motor engineering, but do not fill the bill for beginners. Withal it contains so much of real merit that I can recommend it heartily not only to those for whom it has been specially written, but to all interested in motoring.

JOHN FARSON.

Chicago, October, 1906.

DICTIONARY OF AUTOMOBILE TERMS.

Accelerator—Regulating device for engine speed.

Accumulator—A secondary cell for storing of electric energy.

Advance Sparking—A device for exploding the charge in the cylinder, immediately before the piston starts down on the explosion stroke.

Alternating Current—An electric current which rapidly changes from positive to negative direction and back again.

Ammeter or *Amperemeter*—Instrument for measuring the strength of an electric current.

Ampere—A measure unit of electric energy.

Armature—Part of a dynamo carrying around an iron frame, wire coils, the ends of which connect with the commutator.

Artillery Wheel—The common form of wooden wheel used in motor cars.

Axle, Live—An axle revolving in stationary bearings which carry wheels.

Back Fire—A premature explosion in an internal combustion cylinder, mostly

taking place when the sparking device is too far advanced at starting the engine.

Ball Joint—See Universal Joint.

Band Brake—A brake in which steel bands cause the retarding friction, either internally or externally, by expansion or contraction.

Battery, Primary—A battery in which an electric current is generated.

Battery, Secondary—A battery or device in which electric energy is stored.

Belt Drive—Transmission of motive power from motor to countershaft by means of belts.

Bevel Wheel—A toothed wheel with its face cut at an angle.

Bobbin—The induction coil supplying the high tension spark for ignition.

Bore—The diameter of the cylinder chamber.

Breech Piece—Part which closes the end of a cylindrical chamber.

Brush—Part of commutator used in collecting and distributing electric current from commutator.

Cam—An irregular disk, mounted on a revolving shaft for the purpose of producing a changeable motion in another part of an engine.

Cam Shaft—A shaft or spindle carrying a cam.

Carbide—The chemical from which acetylene for a generator is produced.

Carbureter—The apparatus in which gasoline or other explosive fuel is vaporized and mixed with air to produce the charge for the cylinders. (See chapter on Carbureter.)

Cardan Drive — Transmission of power from engine by means of a shaft, the ends of which move in universal or ball joints.

Cardan Shaft—A shaft jointed with universal or ball joints.

Chain Drive—Transmission of power from engine by means of chains.

Change Speed Gear—The wheel or gear arrangement to produce the different speeds of an automobile.

Chassis—The French term for the frame on wheels which carries the machinery and other mechanism of a motor car. It includes all parts of the car except the coachwork.

Chauffeur (*Fr. sho-fur*)—French term for driver of an automobile.

Circuit—The path of an electric current from one pole of a battery to the other.

Clutch—The mechanism which connects the transmission system with the motor for the purpose of acquiring the driving power.

Combustion Chamber—The space between the piston and cylinder head in which the explosive charge is burned.

Commutator—The part of the electric ignition apparatus which makes an electric contact at definite periods to regulate the time of firing the charge. It is mounted on the timing shaft.

Compensating Gear—See Differential Gear.

Compression—The reduced volume of the explosive charge between the piston and the cylinder head, after the compression stroke.

Compression Stroke — The second movement of the piston, in the four-cycle system, which compresses the charge.

Condenser—A steam engine device for converting exhaust steam into water.

Connecting Plug—See Switch Plug.

Connecting Rod—The metal rod connecting the piston with the crankshaft.

Contact Breaker—The mechanism for making and breaking the low tension circuit of the ignition system.

Cooling System—The method of cooling, by air or water the over-heated walls of a cylinder.

Countershaft—The transversal shaft, carrying the sprocket wheels, through which engine power is transmitted to the driving wheels.

Coupling—A connection of two shafts in the same plane which allows of disconnection.

Crankshaft—The shaft in the engine base to which the piston rods are attached.

Crypto Gear—See Planetary Gear.

Cylinder—The part of the motor into which the explosive charge is admitted for developing the power.

Densimeter—An instrument for measuring the specific gravity of liquids in comparison with water.

Differential Gear—The mechanism which enables the two rear wheels to revolve at different speeds when turning a corner.

Dished Wheel—A wheel the hub of which is sunk below the plane of its rim.

Distance or Radius Rod—The rod connecting the axle arms carrying the front wheels, also the rod which keeps the chains between the rear axle and

sprocket wheels on the countershaft at tension. Any rod used to keep a relative distance between parts.

Distributor—A mechanism for carrying electricity to different rotating points.

Dog Clutch—A clutch, the square-jawed projections of which fit into the hollow parts of the same.

Dry Battery—See Battery, Primary.

Dynamo—An apparatus for converting steam, water or any other energy into electricity.

Eccentric—Out of center—A device to convert rotary motion into up-and-down motion.

Efficiency, Motor—The proportion of working force derived from the fuel heat.

Electrolite—The acid or alkaline fluid in a cell which produces the electric current.

E. M. F.—Abbreviation for "Electro Motive Force."

Epicyclic Gear—See Planetary Gear.

Essence—The French term for gasoline.

Exhaust Stroke—The fourth piston stroke in the four-cycle system which expels the burned charge.

Expanding Clutch—A clutch in which friction is caused by internal steel bands being forced against the inside of an enclosing ring.

Explosion Chamber—See Combustion Chamber.

Fat Spark—A short but wide electric spark, caused by a strong current, in contrast to a thin spark caused by electric weakness.

Float—The hollow cylinder in the gasoline chamber of the carbureter which maintains the level of the fuel at a certain point.

Flywheel—The heavy wheel at the end of the crankshaft which is used to give momentum in starting, and forms part of the clutch.

Four Cycle or Otto System—The four piston strokes of an internal combustion motor which perform the operation of rotating the crankshaft. (See chapter on the Gasoline Motor.)

Frame—The part of an automobile which carries the machinery. The term is sometimes applied to the whole lower part of the car on which the body is mounted.

Free Engine—An engine which can be disconnected from the transmission of

a vehicle, to which it is attached, by means of a clutch.

Friction Clutch—A system of clutch in which the connection between the two revolving parts (male and female cone) is effected by friction. (See chapter on The Clutch.)

Garage (*Fr. ga-razh*)—A French term denoting a place where cars are stored, repaired or sold.

Gear Case—The oil-tight metal case containing the speed change gear of a car. Any box enclosing gears.

Generator—Any mechanical or chemical energy producing power. Generally applied, in motor parlance, to the apparatus supplying acetylene to the lamps.

Governor—An apparatus for the regulation of the motor speed in relation to the work performed.

Gradometer—An instrument for measing the grade of elevations.

Ground Wire—Part of the wiring system of a car which carries the current to some part of the chassis, thereby closing the circuit.

Goggles—Spectacles for motorists.

Half-speed Shaft—See Cam Shaft.

High Tension Circuit—The induced current circulating between the two ter-

minals of the electric coil through the spark plug.

High Tension Wire—A wire for carrying strong electric currents.

Honeycomb Radiator—A radiator, the pipe arrangement of which resembles a honeycomb.

Hydrometer—See Densimeter.

Ignition—The system of batteries and wiring by means of which the firing spark in the cylinder is produced. (See chapter on Ignition.)

Internal Combustion Engine — See chapter on Gasoline Motor.

Interrupter—An electric switch for the breaking of the low tension circuit.

Jump Spark—The ignition spark between the two closely placed wire ends of the sparking plug.

Knocking—A characteristic noise in the engine caused by some defect.

Lorry—A heavy, shallow-sided motor truck.

Magneto—See chapter on Ignition.

Manometer—Device for indicating water pressure in the cooling arrangement of an internal combustion motor.

Misfire—Failure of regular firing in combustion chamber.

Mixture—The explosive vapor resulting from the mingling of gasoline or alcohol particles with air.

Mixture Chamber—The part of the carbureter in which the mixture of air and gasoline particles takes place.

Muffler—The apparatus designed for reducing the noise of the explosions in the cylinders. Connects with exhaust pipe. (See chapter on Muffler.)

Neutral Point—The point to which the speed lever is brought when letting the engine run free.

Petrol—Term used in Great Britain for gasoline.

Piston Ring—The flexible rings fitting into the grooves of the piston for securing better lubrication and compression.

Pneumatic Tires—Rubber tires inflatable by air.

Premature Ignition—The explosion of the charge in the combustion chamber before the piston has completed the compression stroke.

Puncture—The damage caused to a tire by piercing it.

Radiator—The part of the cooling system comprising the thin metal pipes through which the water circulates. (See chapter on Cooling.)

Rheostat—An apparatus for graduating the strength of a current in a closed electrical circuit.

Regulator—The lever of a steam car controlling the steam admitted to the cylinders.

Reversing Gear—The mechanism by which a car is enabled to move backward.

Runabout—A light car with seating capacity for two.

Running Gear—The lower part of an automobile, comprising the frame, springs, axles, wheels, etc., without including any working part of the machinery.

Short Circuit—A defect in the electric circuit which allows the current to escape into the car-frame, weakening or altogether stopping the firing spark.

Silencer—Term for muffler in Great Britain.

Skidding—The lateral slipping of the rear wheels, caused by wet or sandy condition of the road.

Spark Plug—The insulated plug, connecting with the combustion chamber in the cylinder, between the closely placed wire ends of which the jump spark plays.

Spring Buffer—A device to eliminate

the bouncing of the car springs when going over rough roads at high speed.

Sprocket—A toothed wheel to receive a chain transmission.

Steering Gear—The mechanism for giving a motor car the direction in which it is desired to travel. (See chapter on Steering Gear.)

Storage Battery—See Accumulator.

Stroke—The length which the piston can travel in the cylinder.

Switch Plug—The plug used for turning on and off the electric current of the ignition.

Tank—The receptacle for the fuel or water in a motor car.

Throttle—The small lever, generally placed on the steering column, which controls the supply of the mixture to the cylinders.

Throttle Governor—An apparatus for automatically retarding the speed of a car when exceeding a certain limit.

Timing Gear—The shaft and cam system for regulating the time of sparking in the cylinder and the regularity of suction and exhaust valves.

Transmission—The mechanical system for transmitting power from the en-

gine to the driving wheels. (See chapter on Transmission.)

Universal Joint—A joint which allows angular movement between two connected shafts which lie in a different plane or which are subject to different positions.

Ventilator—The revolving fan behind the radiator which cools the pipes.

Volt—The unit of measure in electric currents.

Voltage—The strength of an electric current expressed in volt units.

Voltmeter—See Ammeter.

Waterjacket—The metallic enclosure around the cylinders of the water-cooled gasoline motor which forms part of the cooling system.

Wipe Spark—A low tension circuit spark generated at the moment when striker and plug inside the cylinder separate. A primary sparking device principally used on stationary, gasoline and marine engines.

Worm Gear—An endless screw meshing with a section of a toothed wheel. (See chapter on Steering.)

TO GO beyond the bounds of moderation is to outrage humanity. The greatness of the human soul is shown by knowing how to keep within proper bounds. So far from greatness consisting in going beyond its limits, it really consists in keeping within them.

PASCAL

(Adapted to Motoring)

CHAPTER I

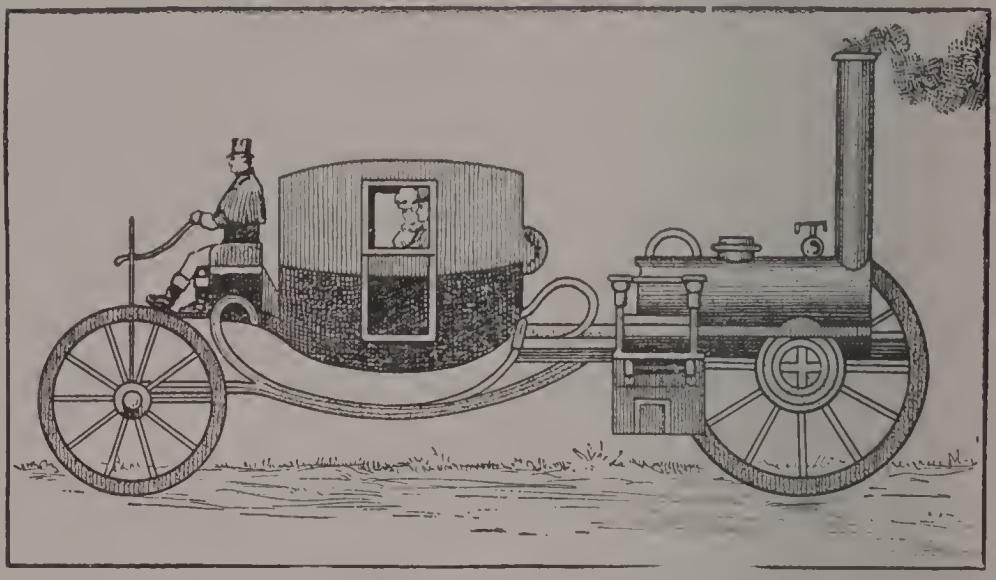
GENESIS OF THE AUTOMOBILE.

Horseless vehicles, such as the various forms of the present-day automobile, are not an invention of modern times. They are an evolution of ideas and experiments which originated as early as the Middle Ages and the germs of which may, perhaps, be sought for in the mazes of antiquity.

So far as definite historical knowledge is concerned, Holland and Germany were the first countries where trials in this direction were made by using wind and spring power as motive forces, and in England a patent for "drawing carts without horses" was issued to Ramsay and Wildgoose as early as 1619.

Most noted among other men credited with experiments of horseless carriages are the Italian, Giovanni Banca (first part of the 17th century), the Englishmen, Sir Isaac Newton (1642-1727), W. Symington (1764-1831) and Richard Trevithick (1771-1833), and the Americans Nathaniel Read and Oliver Evans

(end of the 18th century), all of whom worked with the principle of steam as motive power in their inventions.



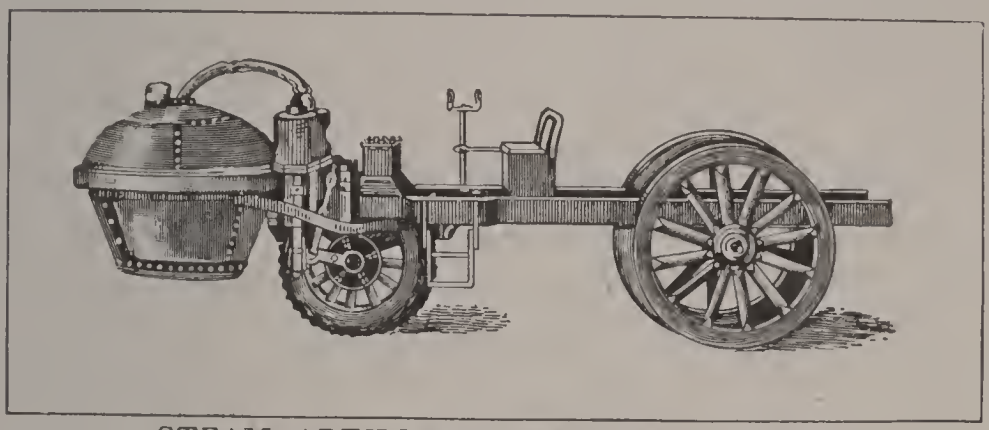
SYMINGTON STEAM CARRIAGE.

It is the Frenchman, Nicholas Joseph Cugnot, however, who is generally regarded as the real father of the steam automobile. His first model was constructed in 1769 with the aid of government funds, but was improved by him in 1770, and, while not altogether practical and somewhat complicated, some of the ideas contained in it were used, in simplified form, until recent times, by later constructors.

Trevithick's steam carriage (1802) was the first one in which power was transmitted by gears, and Griffiths built in 1821, for the first time, a steam vehicle

with comfortable passenger accommodation and tubular boiler system.

In 1824 and 1825 W. H. James, Burstall and Hall, and David Gordon pat-



STEAM ARTILLERY CARRIAGE (Cugnot).

ented other systems (the latter a push-foot scheme) which were followed in 1828 by Gurney's and in 1831 by Summers' steam coaches. Walter Hancock's invention of an auto omnibus (1829-1833) with high pressure boiler was the most important step towards the perfection of the steam automobile.

France, where since Cugnot's invention nothing had been accomplished in automombile improvements with the exception of Pecqueur's wagon (1828) which contains the germ of modern automobile mechanism, was destined to become again the field of important efforts in 1862 when Lenoir experimented with gas motors. Ravel, in 1870, followed

along the same line, and in 1873 Amadée Bollée constructed a practical steam car for twelve passengers which he improved considerably in 1880. During 1888 and 1889 other steam cars were successfully built by Dion & Bouton and by Serpollet.

Efforts to employ electricity as motive power for automobiles were made a little in advance of internal combustion. Electric tricycles were constructed in 1881 by G. Trouvé, and in 1882 by Ayrton, while a four-wheeled vehicle by Immisch in 1888 was followed in 1893 and 1894 by Pouchain's and Jeantaud's electric phaetons.

It was a German, Gottlieb Daimler, who contemporaneously with his countryman, Benz, secured in 1886 a patent on the internal combustion gasoline motor which was destined to become the real prototype of the modern automobile, but to the two Frenchmen, Panhard and Levassor, is due the honor of having evolved this type to a degree which made possible the great development of the motor car industry at the beginning of the 20th century.

CHAPTER II

MOTOR CAR TYPES—THEIR ADVANTAGES AND DISADVANTAGES.

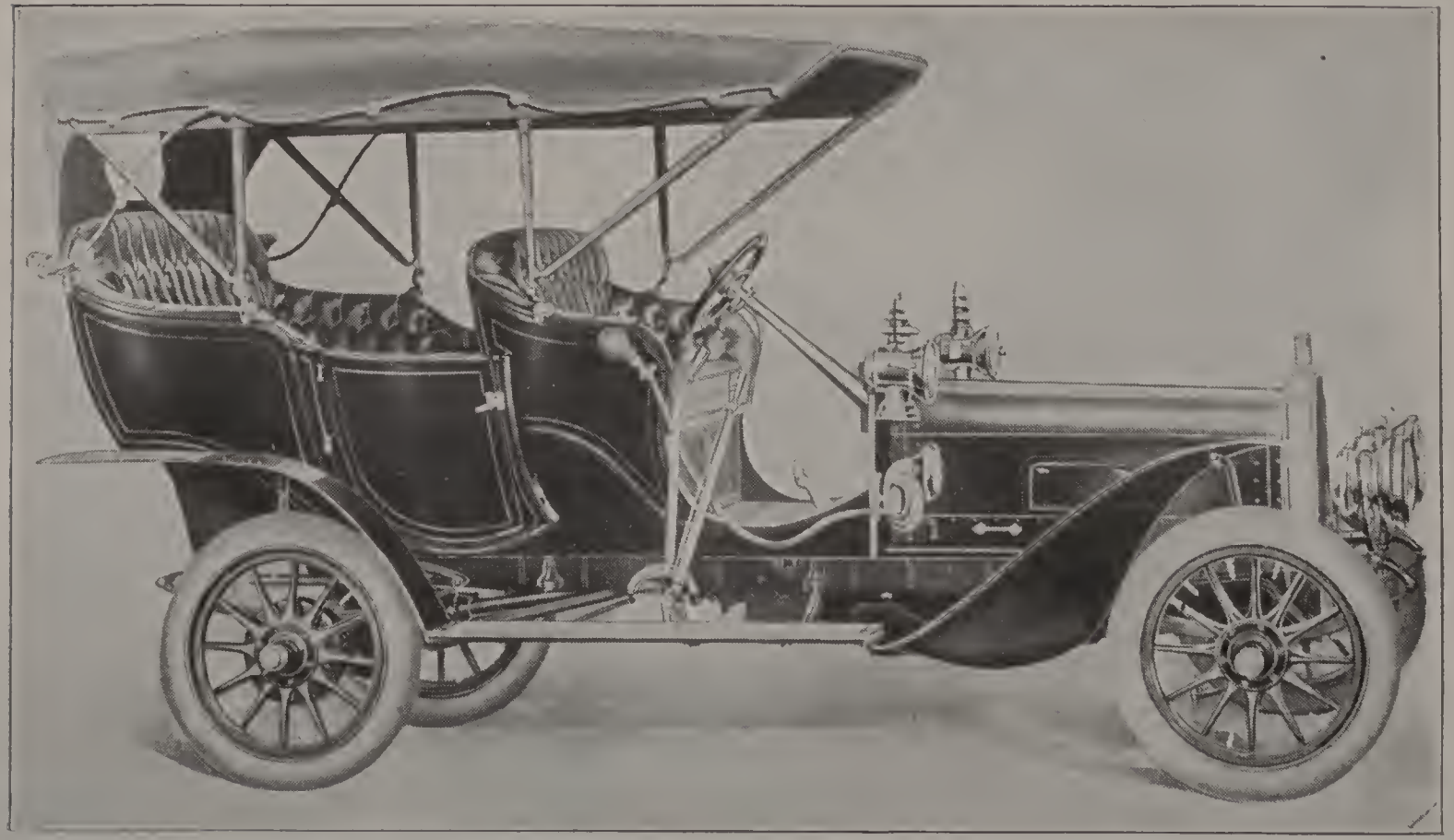
The three principal motive powers employed in the construction of modern automobiles, in their present order of popularity, are Gasoline, Electricity and Steam. The cars of the first type also include those propelled by alcohol and kerosene internal combustion engines. There is another car type, the "Compound," in which a combination of internal combustion and electricity is employed in the way of utilizing a gasoline motor to drive a dynamo, but its use is too limited to justify going into details.

Of the three types first mentioned the GASOLINE CAR is the most popular. Its advantages are economy of maintenance, simplicity of construction, capability of great speed, quick starting possibility, light weight, almost unlimited radius of action and comparative cheapness of initial cost. Its disadvantages are dirt, noise, odor and small range of engine flexibility, but improvements have of late been so radical as to promise considerable lessening of these nuisances.

The Gasoline Car derives its power from direct consumption of the fuel, and works most economically and satisfactorily at constant speed. The various speeds, which generally range from two to four, are obtained by intermediary gears which are arranged in a certain ratio to each other, and control the revolutions of the road wheels. In chain-driven cars the transmission of power from the engine to the wheels takes place through the crank-shaft, counter-shaft, chains and sprockets. In shaft or cardan-driven machines the power is transmitted through the gear case to a jointed shaft in the center of the car connecting directly with the rear axle where it is communicated to a large bevel wheel.

The tendency in Gasoline Cars lately has been for direct drive on the high speed, for chain drive in heavy touring and racing cars, and shaft drive for lighter models. Vertical position of engine is preferred to the horizontal and the placing of the motor in front under the hood is quite generally adopted on account of greater accessibility.

ELECTRIC AUTOMOBILES derive their motive power from electric currents either stored or generated in the



A MODERN SIX-CYLINDER GASOLINE AUTOMOBILE (Ford).

vehicle itself, and an electric motor differs from a dynamo only in so far as it is used to create motive power from electricity, while the latter transforms motive power into electric currents.

The advantages of an Electric Car are silent running, absence of shocks, bad odors, heat and delays in starting, and absolute control of speed without the use of complicated gears. Its disadvantages consist of heavy weight, difficulty of procuring motive power, sensitiveness of batteries against road vibrations, necessity of considerable knowledge and experience in proper handling, short radius of action and constantly increasing proportion of dead weight as the batteries are exhausted in running.

In generating an electric current in the car, it can be used either directly from the dynamo or it may be stored in the battery and supplied from there as needed. The latter arrangement is preferable, but there are certain difficulties which have, as yet, not been overcome, and for that reason the electric vehicle with storage battery is in more general use. Stored electricity for supplying the motor of an Electric Automobile is carried in storage batteries which must be re-charged after exhaustion, and it is

principally the limitation as to places where motive power may be secured which is the main reason that the use of Electric Vehicles is confined to larger cities.

STEAM CARS, in spite of the priority of motive power, have experienced a less radical evolution than gasoline automobiles, and their use is rather limited. The special advantages which may be claimed for this type are smoothness of running, capability of great speed, absence of noise and odor, reliability of system and simplicity of transmission. Its disadvantages may be enumerated as impossibility of quick start, danger of explosion, especially in collisions, attention required, large consumption of fuel and necessity of frequent water supply which often cannot be found suitable as to its chemical composition.

The types of Steam Cars are, however, so varied that a statement of their disadvantages must be qualified according to circumstances. America and France have so far produced the most successful steam cars. In England they have found a limited number of adherents, while Germany and other European countries have, as yet, refrained from giving them a place in their motor industry.

Modern Steam Automobile (White).
Modern Electric Automobile (Columbia).

CHAPTER III

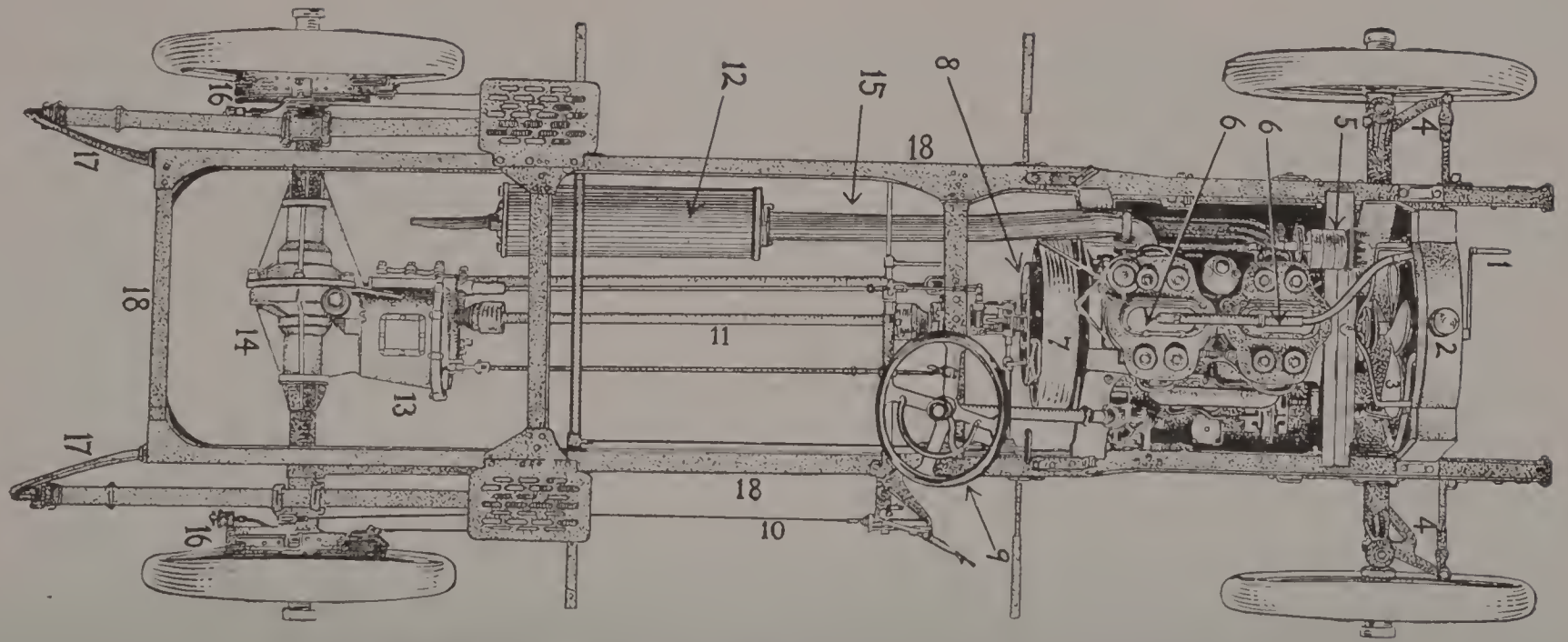
ANATOMY OF THE GASOLINE AUTOMOBILE.

A motor car may be properly divided in two parts, the *chassis* and the body. The chassis consists of the car frame to which is attached the running gear, and which carries the mechanism, while the body comprises the coach work.

Beginning with the front of the car, the chassis contains the turning crank which sets the car in motion, the radiator through which the cooling water circulates, the ventilator to assist in the cooling, the water-pipes leading to and from the motor, the engine and the flywheel. These parts with their minor attachments for ignition and lubricating form the engine group proper.

The principal parts of the engine itself, which is bolted on an oil-tight base or crank case, comprise the waterjacket, the cylinders with pistons, piston rings, piston rod and valves, crankshaft, camshaft and carbureter.

Following the engine comes the transmission. This consists of the clutch, fitted into the flywheel, the driving shaft,



ANATOMY OF THE CHASSIS (Packard). — Top View.

1. Crank handle.
2. Radiator,
3. Ventilator.
4. Steering knuckle.
5. Magneto.
6. Cylinders.
7. Fly-wheel.
8. Clutch.
9. Steering wheel.
10. Brake rod.
11. Cardan shaft.
12. Muffler
13. Gear Case.
14. Differential.
15. Exhaust pipe.
16. Brakes.
17. Spring suspension.
18. Frame.

the gear case, containing the speed change gear, the transversal countershaft (in chain-driven cars) or the cardan-shaft (in shaft-driven cars), chains and differential or compensating gear.

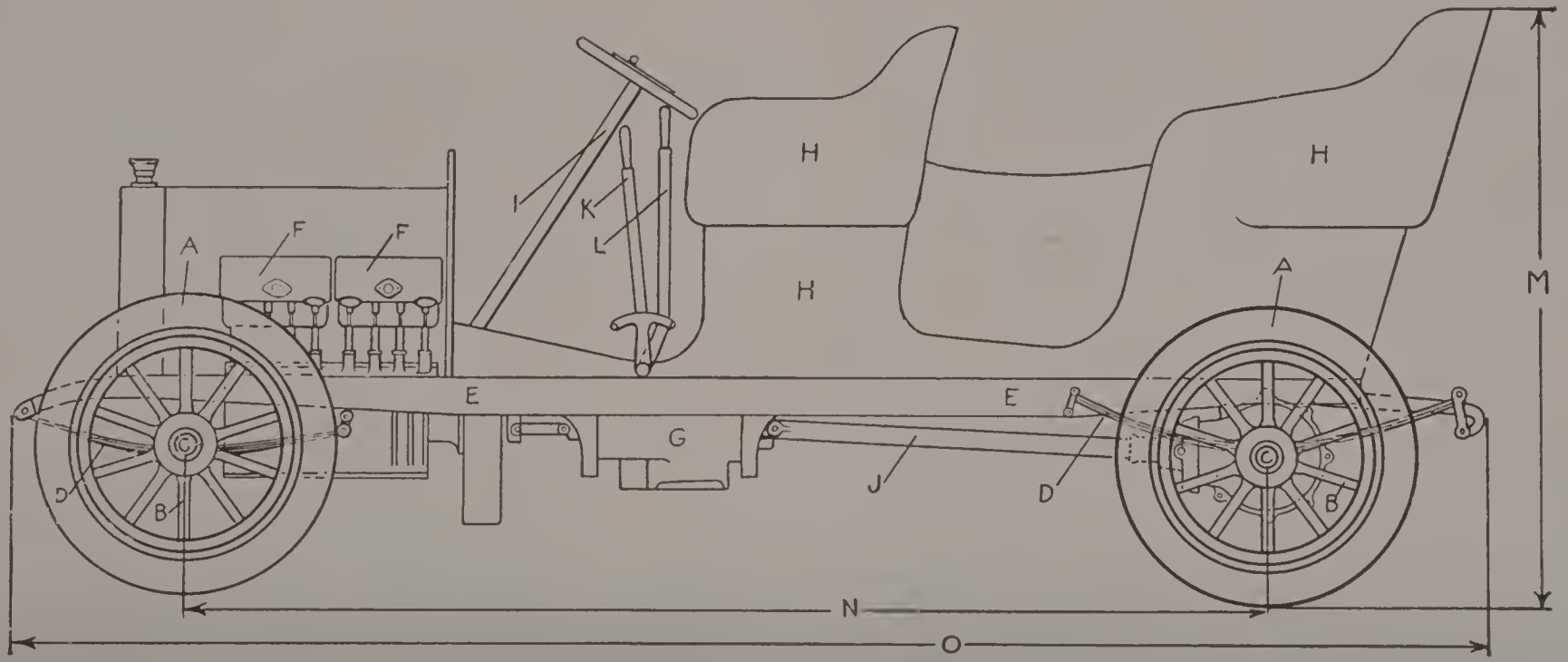
To the running gear belong the springs, axles, wheels and brakes.

The chassis carries further the steering device and levers, the fuel tank, the electric apparatus, the muffler, running board and mudguards.

The supporting frame, to which all these parts are attached, may be made of angular steel, tubular steel, pressed channel steel, wood or armored wood.

The body or coachwork comprises the car floor, the dashboard, the front seats, the rear seats (tonneau), hood and stationary hampers.

Other adjuncts of a motor car, such as generator, toolbox, lamps, horn, tops, etc., are attached to various convenient parts of chassis or body .



PLAN OF MOTOR CAR — (Side Elevation).

A Tires.
B Wheels.
C Axles.
D Springs.
E Steel Frame.
F Motor Cylinders.
G Gear Change Mechanism.
H Body.
I Steering Device.
J Drive Shaft.
K Brake Lever.
L Gear Change Lever.
M Height over all.
N Wheel Base.
O Length over all.

CHAPTER IV

THE GASOLINE MOTOR

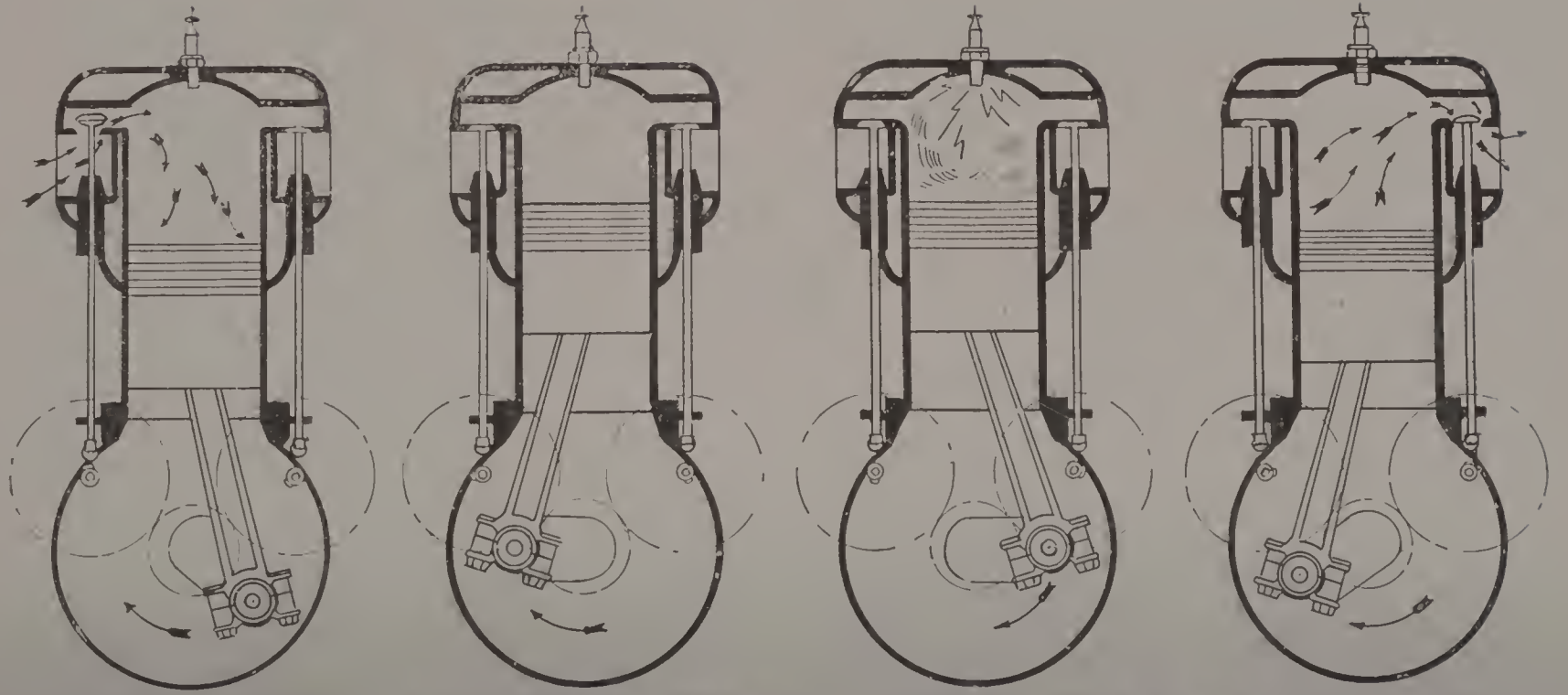
The system almost exclusively employed in the Gasoline or Internal Combustion Engine is the Four-Cycle, otherwise called the Otto system. As indicated by its first name, which is mostly used in America, this cycle consists of four piston strokes. The strokes are performed in the interior of the cylinders, which are the rear seat of the engine's working energy, and are called in rotation of their action as follows:

SUCTION STROKE (forward) — which draws the explosive vapor from the mixture chamber of the carbureter into the cylinder.

COMPRESSION STROKE (backward) — which compresses the mixture between the piston top and cylinder head.

WORKING STROKE (forward)—which is caused by the ignition and consequent expansion of the charge.

EXHAUST STROKE (backward)—which forces the burned gases out of the combustion chamber, leaving again a vacuum for the first or Suction Stroke.



FOUR-CYCLE SYSTEM.

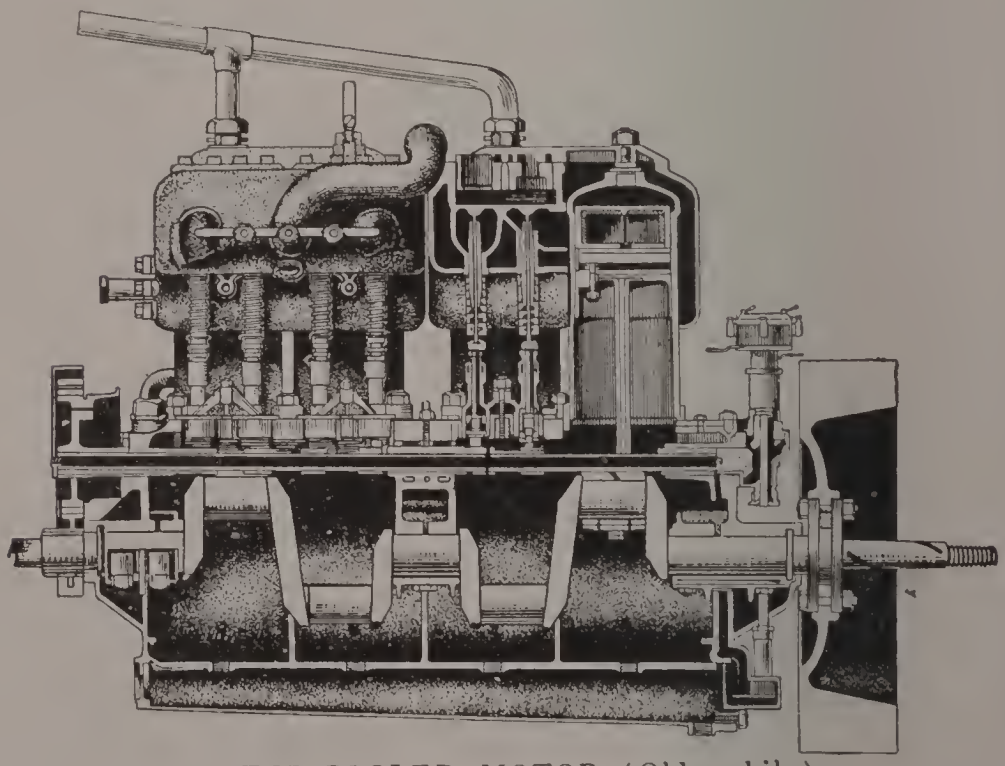
Suction and exhaust take place by means of valves which are operated either automatically or mechanically. The latter method is the more reliable and is much to be preferred. It depends for motion on the half-speed camshaft in the engine base.

The firing of the charge, which has to be properly timed, is effected by an electric spark in the cylinder, created by various systems of ignition. The electric force for this purpose may be gained either by a magneto apparatus worked by the motor, or by a stored current from dry cell batteries or accumulators.

Since there is only one working stroke in the two forward and two backward strokes which cause the two revolutions of the crankshaft, a heavy flywheel which by its momentum absorbs some power from the motor, is attached to the latter at the end of the crankshaft for the purpose of starting the engine by hand and keeping it going during the periods of the cycle when no fresh impulse is given. This flywheel differs in weight with the size of the car and cubic measurement of the compression chamber in the cylinder.

The mixture which produces the real

motive power by its explosion is the result of a proportionate mingling of air with the gasoline vapors in the mixture chamber of the carbureter, from where it is drawn into the cylinder, by means of a tube and the suction valve. Its supply is regulated by a throttle generally placed on the steering wheel. The burned gases



WATER-COOLED MOTOR (Oldsmobile).

are expelled through the exhaust valve into a pipe leading to the muffler, (an apparatus for silencing the sound of the explosions) and thence into space.

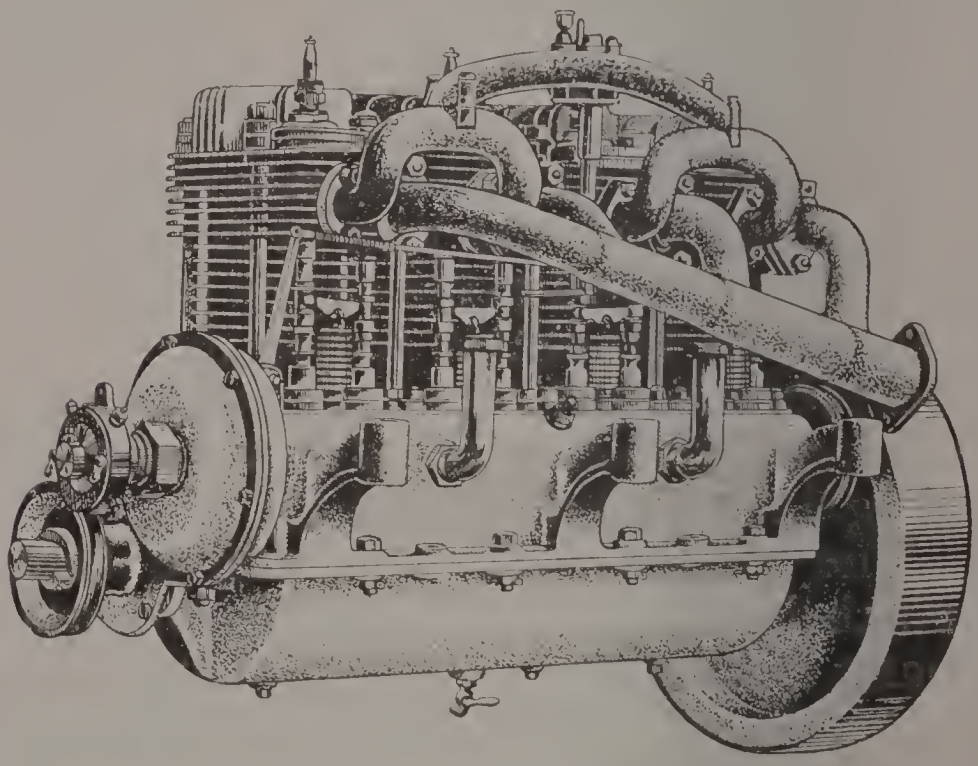
The cylinder walls, which absorb excessive heat from the constant explosions,

are cooled by a circulating stream of water between them and an outer metallic jacket. Circulation is effected either by means of a mechanically operated pump which forces the water through the cooling raditor or by a natural gravity system called the thermo-syphon system. The cylinder heads of a modern engine are generally cast in one piece with the cylinders, the latter either being arranged singly or in pairs, each system having its advantages and adherents, while the lower part of the casting is tightly screwed to the engine base. In case of an air-cooled motor the water jacket is naturally done away with, as the cooling is then effected by means of radiating flanges or pins.

The crankshaft in the engine base, which is partly filled with oil for automatic lubrication, is connected with the pistons by means of piston rods, and imparts the rotary motion which it receives from that source to the flywheel, the clutch, driving shaft and running gear to the road wheels. By means of camshafts and meshing gears it also operates various smaller parts of the engine, such as valves, oil and water pumps, etc.

Regarding the general design of gaso-

line motors vertical form is by far the most popular. Horizontal motors are, however, still in limited use, while the number of inclined ones, except in motor cycles, is infinitesimally small. Motors are generally classified by the number of cylinders, and it is conceded that with



AIR-COOLED MOTOR (Orient).

the four and six-cylinder engine, increased reliability and efficiency go hand in hand.

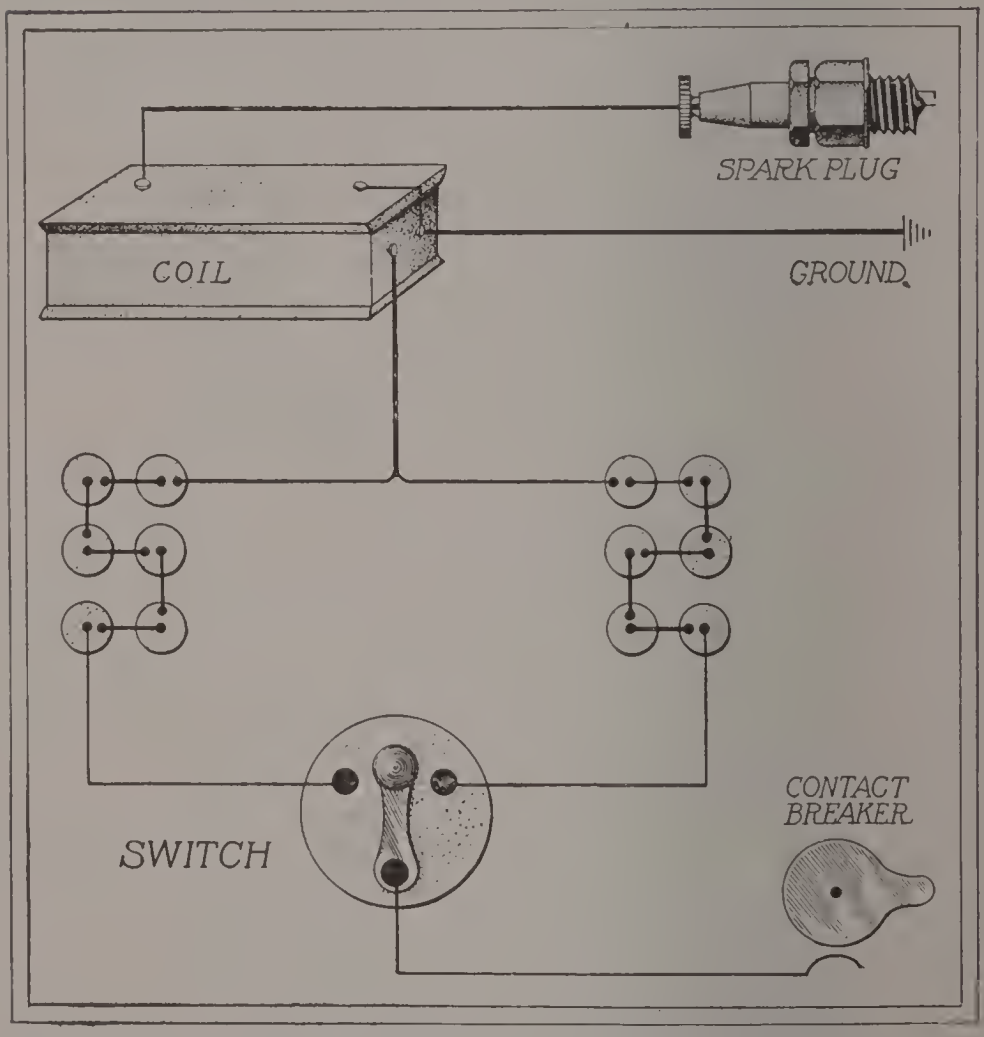
An exception to the Four-Cycle system in general use must be noted in the Two-Cycle motor which is used by a few auto-

mobile constructors. This system performs in two strokes the functions of suction, compression, combustion and expulsion, but its principle entails a loss of energy and an increased use of fuel which operate against its wide adoption for motor cars until radical improvements will make it more practical.

CHAPTER V.

THE IGNITION.

The proper installation and working of the ignition apparatus in connection with the internal combustion motor is of



WIRING FOR TWO SETS OF BATTERIES.

the greatest importance, as a lack of care in this regard is invariably followed by

serious trouble in the running of an automobile.

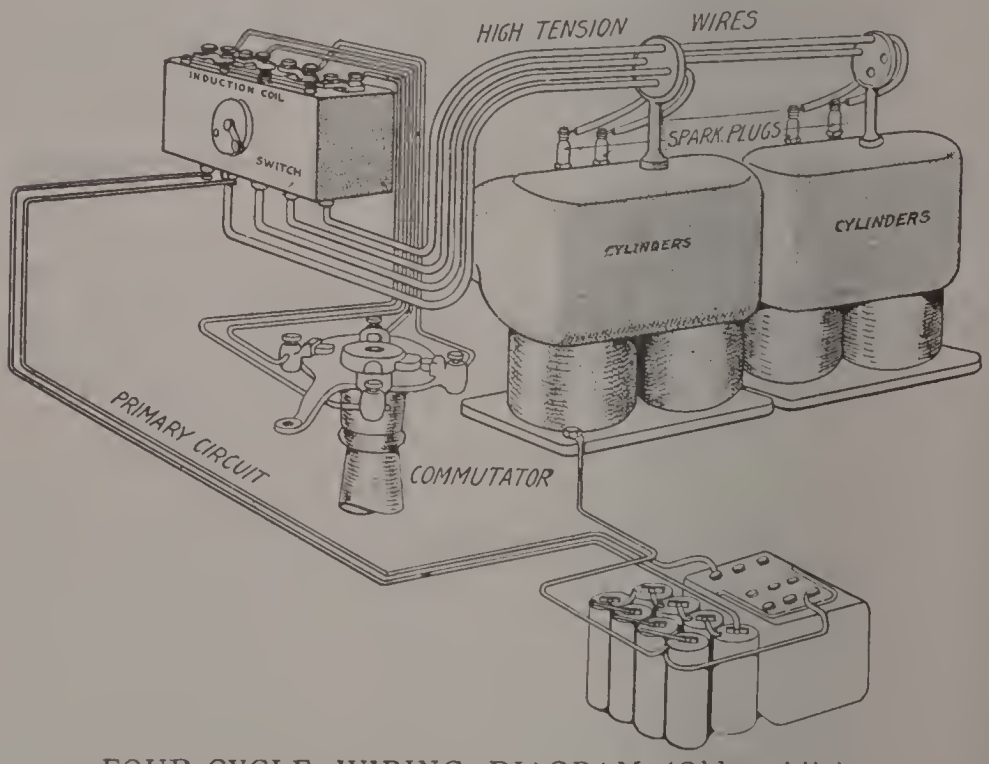
There are several systems of ignition in use, such as electric, tube and incandescent, but electricity has nearly supplanted all other methods.

In this system the spark for the firing of the charge in the cylinder can be created either by means of a constant electric current (produced by a so-called primary element, generally "dry cells," or by a secondary element, an "accumulator," storing up energy from a dynamo) or through a magneto apparatus worked by the motor itself.

The first method is called the High Tension System, and its mechanism is made up of the battery, the coil, the switch, the connection plug, the commutator and the spark plug. There is a difference, however, between the efficiency of a Dry Battery and an Accumulator. The strength of the first gradually declines with use, and the battery has to be discarded and renewed after its exhaustion, while the accumulator is always capable of being cheaply re-charged. On the other hand the radius of action of the latter, without recharge, is not nearly so large as that of the Dry Battery.

The Magneto apparatus consists of a steel magnet which, unlike that of a dynamo, is *permanently* magnetized, and depends for its electric current on breaking or momentarily diverting the force lines between the two poles of the magnet and an armature wound with insulated wire coils.

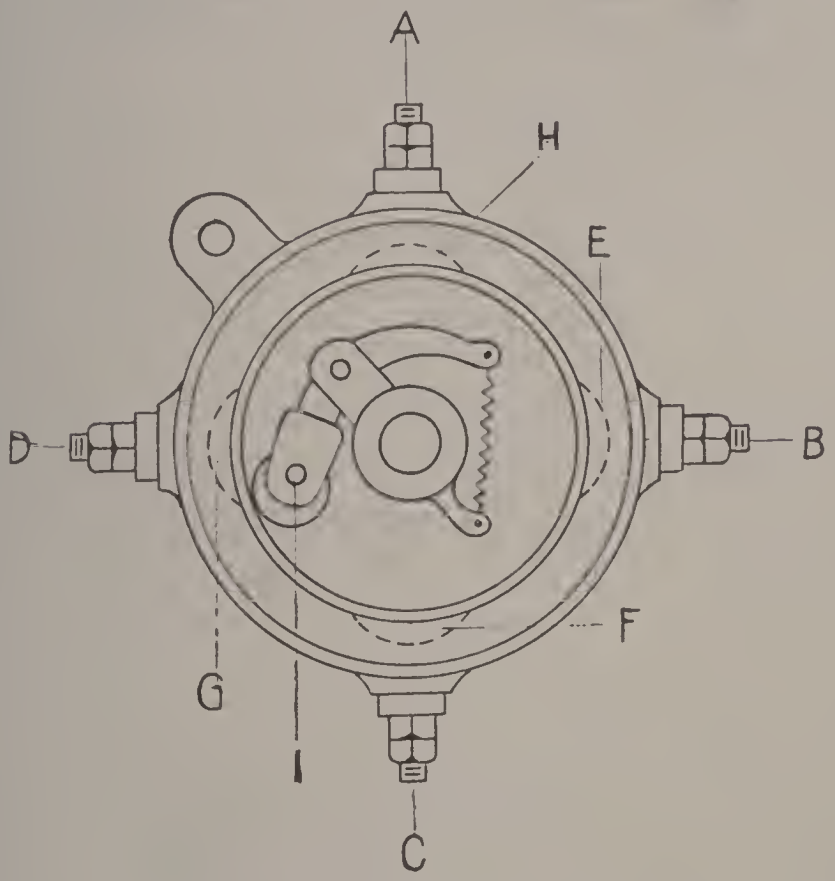
While there is practically no wiring in the Magneto ignition, there are var-



FOUR-CYCLE WIRING DIAGRAM (Oldsmobile).

ious ways of wiring up a high tension system, but in any case it is of importance that the wires should be well insulated, (stranded and tinned wire is preferable on account of its greater flexibility and

because it carries the current more reliably) and that both, high and low tension circuits are complete. To produce a good spark the wiring must be done with great care. The system of doing this depends on the coil, and this again on the commutator, while in the multiple

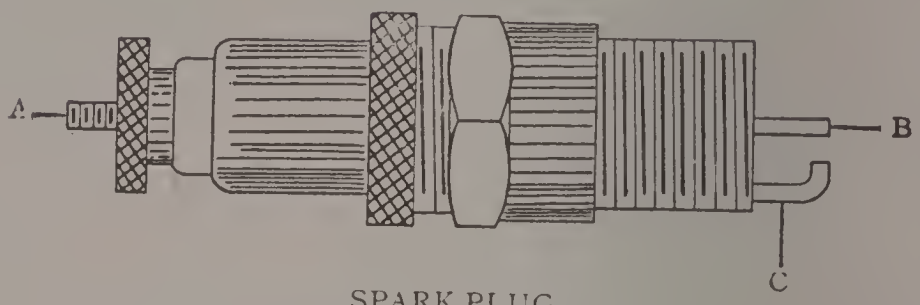


COMMUTATOR.

A, B, C, D, Terminals leading to Spark Coil; E, F, G, H, Contact Points, I, Place for attaching Spark Advance Lever.

cylinder engine the angles at which the cranks are set have also to be taken in consideration if the spark plugs are to fire the charge at the proper moment of the revolution.

The course of the current forms a circuit from the battery to the spark plugs and varies in its passage through the different parts of the electric arrangement according to the system of ignition



SPARK PLUG.

A, Terminal for wire from spark coil: B and C, Platinum points between which the spark jumps.

employed. The fact that the relative position of the parts of an ignition system vary on different motor cars has no effect whatever on the principle.

CHAPTER VI.

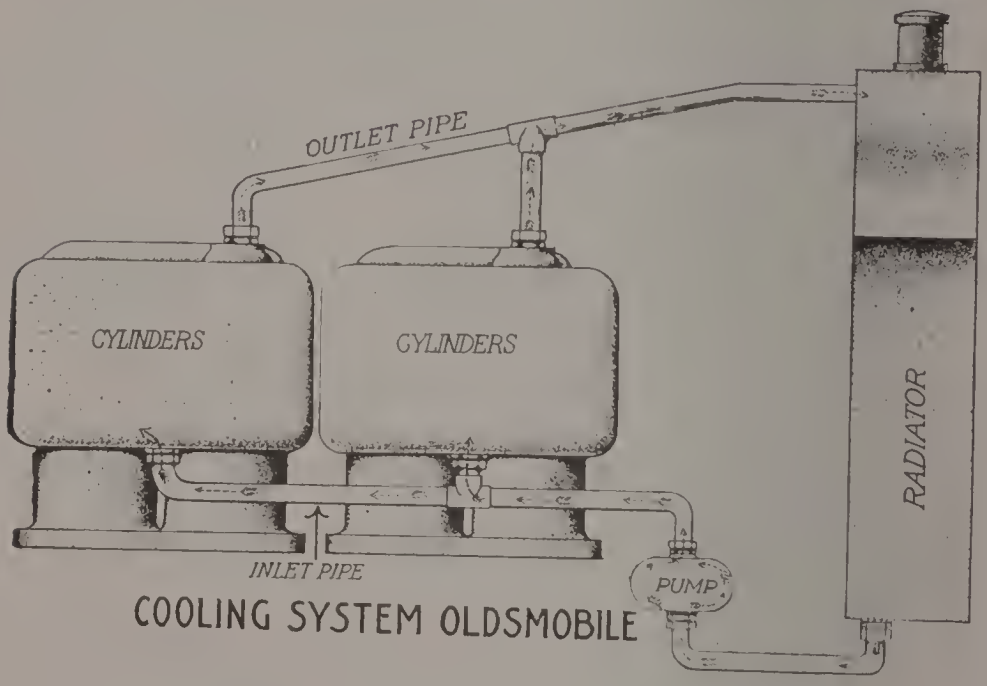
COOLING OF THE ENGINE.

The rapid and constant explosions of the gas mixture in the cylinders of a working internal combustion engine, create such excessive heating of the combustion chamber walls that, without the employment of some cooling device, the running of the motor, even for a short time, would be a matter of impossibility.

In modern automobiles two distinct systems of cooling are used, each of which has its adherents. They are air and water-cooling. Of the two, the latter is by far more in popular favor and is, with one notable English exception (the Lancaster), exclusively used by European motor car manufacturers who deem air-cooling only practicable in small motor cycle engines. In America, however, air-cooling has been taken up seriously, and the improvements along this line have been such that the number of manufacturers who turn out air-cooled cars has considerably increased in the last few years. It has to be admitted, too, that, within a certain limit of horse

power, these machines have proved fairly successful on the road.

The fact, however, that air-cooled engines, even in America, form only a small percentage as compared with water-cooled motors, is in itself proof



COOLING SYSTEM OLDSMOBILE

enough, that, for the present at least, their advantages are far outweighed by the latter. There is no doubt whatever that water-cooling is more efficient, and the only arguments that may be brought against this system by its opponents are greater weight of the engine, more elaborate piping and the possibility of the cooling water freezing in a rigorous climate.

Air-cooling is effected by means of integrally cast or attached flanges, pins and other protuberances tending to increase the outer heat-radiating surface of the cylinders, or by devices which suck and circulate a stream of cool air around the combustion chambers. The difference between the several methods in use consists principally in variation of design. Frequently, and notably in cars of larger horse power, a revolving fan, in close proximity to the cylinders, is employed for the purpose of greater cooling efficiency.

In the water-cooling system a so-called water jacket (generally cast integrally with the cylinders) encircles the combustion chambers, the space between the two being filled by water which is circulated, either by action of natural gravity, called thermo-syphon cooling, or by mechanically working force pumps.

Thermo-syphon cooling is the simpler of the two methods, but is not quite so reliable and efficient as the pump feed. It is automatic and is based on the well-known difference in the specific gravity of hot and cold water. In its mechanical arrangement the water tank is placed above the jacket, sending the cold water

first to the bottom of the latter. After absorbing considerable heat from the cylinders, the water rises from there to the top, and flowing out through the radiator emerges again into the tank, having been cooled in its course through the maze of thin metal pipes.

Experience has shown, however, that the cooling effect of the thermo-syphon system is not quite sufficient for the greatest working efficiency of the motor, as the temperature difference between the warm and cold water cannot be made considerable enough to effect a perfectly satisfactory circulation and consequent cooling. It has, therefore, been abandoned by many manufacturers, and the force pump system is coming in more general use for cooling purposes.

In this system the water circulation is made absolutely reliable, as the pump, which is driven by the motor, forces the water through its course which is the same as in the thermo-syphon cooling, i. e.: from the tank to the bottom of the water jacket, the top, the radiator and back to the tank.

The principal part of the water-cooling apparatus is the radiator which consists of a number of closely arranged thin

metal pipes generally placed in front of the motor and car in order to get the benefit of the cool air draft caused by the motion of the vehicle. The length of these thin pipes is a factor in the cooling of the water that circulates through them, which is, moreover, augmented by a powerful ventilating fan in the rear of the radiator.

Against the emergency of the water freezing in tank and radiator during cold weather the use of anti-freezing solutions is recommended, in the choice of which, however, caution ought to be exercised, as some of them have a detrimental chemical effect on the engine parts touched by the water. Unless an effective harmless solution is used, it is more advisable to drain the water, during long stops in cold weather, by means of the cock at the lowest point of the cooling apparatus which can easily be filled again through the opening at the highest elevation of it.

It is, perhaps, needless to say that in the course of running the car, the water supply diminishes gradually by evaporation and must therefore be replenished from time to time.

CHAPTER VII.

THE CARBURETER.

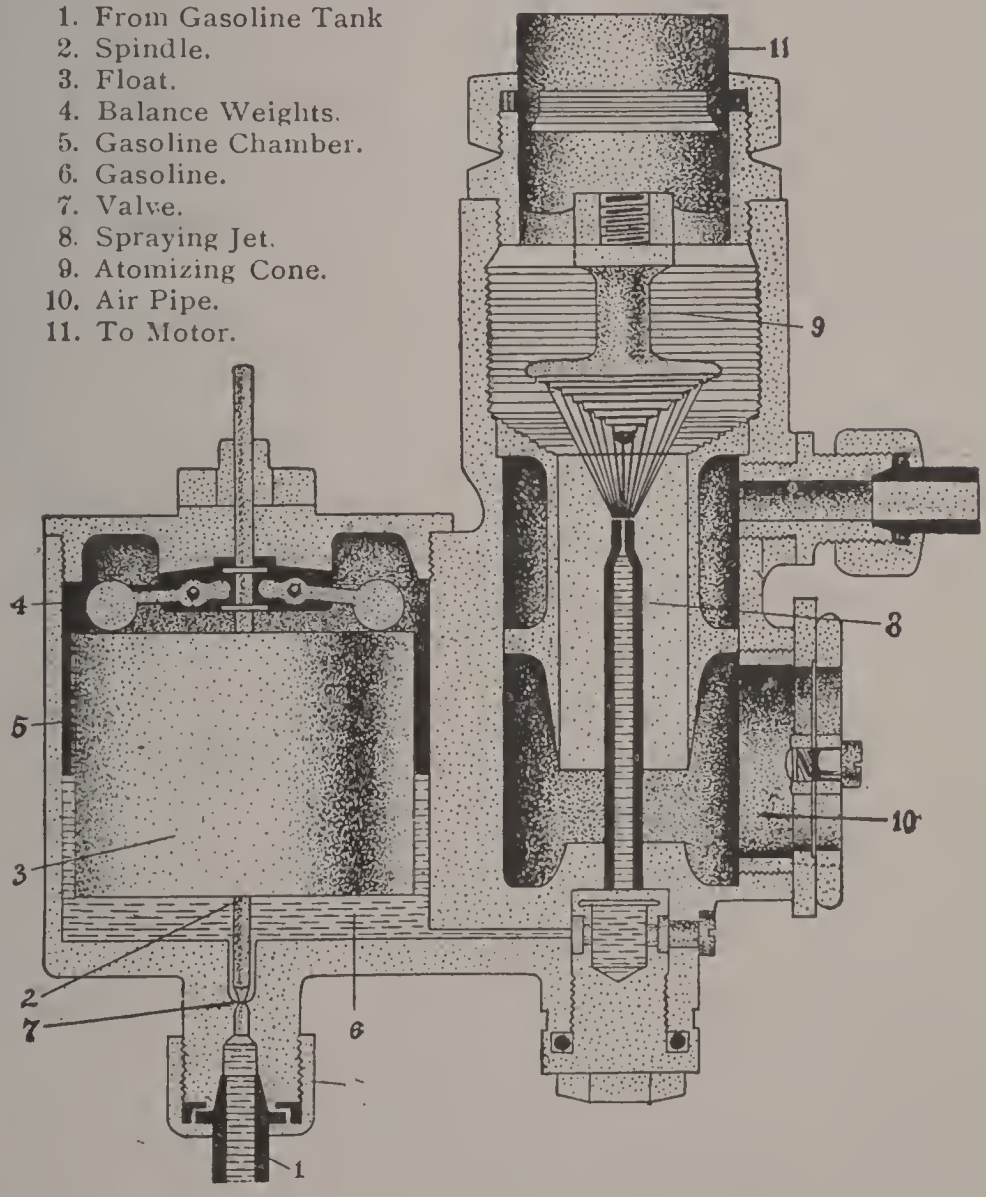
The carbureter is the apparatus in which, by vaporizing gasoline and mingling these vapors in right proportions with warm air, the highly explosive gaseous mixture is produced, which, on being introduced into the combustion chamber and ignited therein by an electric spark, furnishes the motive power for the engine.

This apparatus is of great importance in the anatomy of a motor car, since on its proper working depend, to a large extent, the control of the regularity of the engine's running and the speed of the vehicle. It is connected with the cylinders by means of the inlet pipes, and is always placed in close proximity to the motor in a position where the air introduced in the mixture chamber can be warmed before entering it.

There are too many distinct types of carbureters employed in motor cars to make it possible to describe them individually within the scope of this book, and, therefore, special attention can be

paid only to the most popular type in use at present.

Carbureters can be divided in five classes according to the principles em-



GERMAN SPRAY CARBURETER.

ployed, and may be enumerated and named as the "Wick," the "Bubbling,"

the "Surface," the "Distributing" and the "Float-feed" carbureters. The latter is the most widely used in America, and its principal types are the "Jet" and "Spray" form. The other classes are comparatively unknown or obsolete in connection with modern automobile construction in the United States and regarding them the following statements will suffice:

In the Wick Carbureter, a soft cotton wick, through which air is drawn by the suction of the motor, is saturated with gasoline and forms the evaporating surface for the mixture, which is diluted by an additional current of pure air.

In the Surface Carbureter, the inlet pipe, by its suction, draws the air over the surface of the gasoline, where it gets strongly mixed with the vapors, after which, a further dilution with air, makes it explosive in the desired degree.

The Bubbling Carbureter differs from the Surface type only in that the air is caused to bubble through the gasoline instead of passing over its surface.

The Distributing Carbureter is the least known type. Its results are most satisfactory, but the apparatus is much

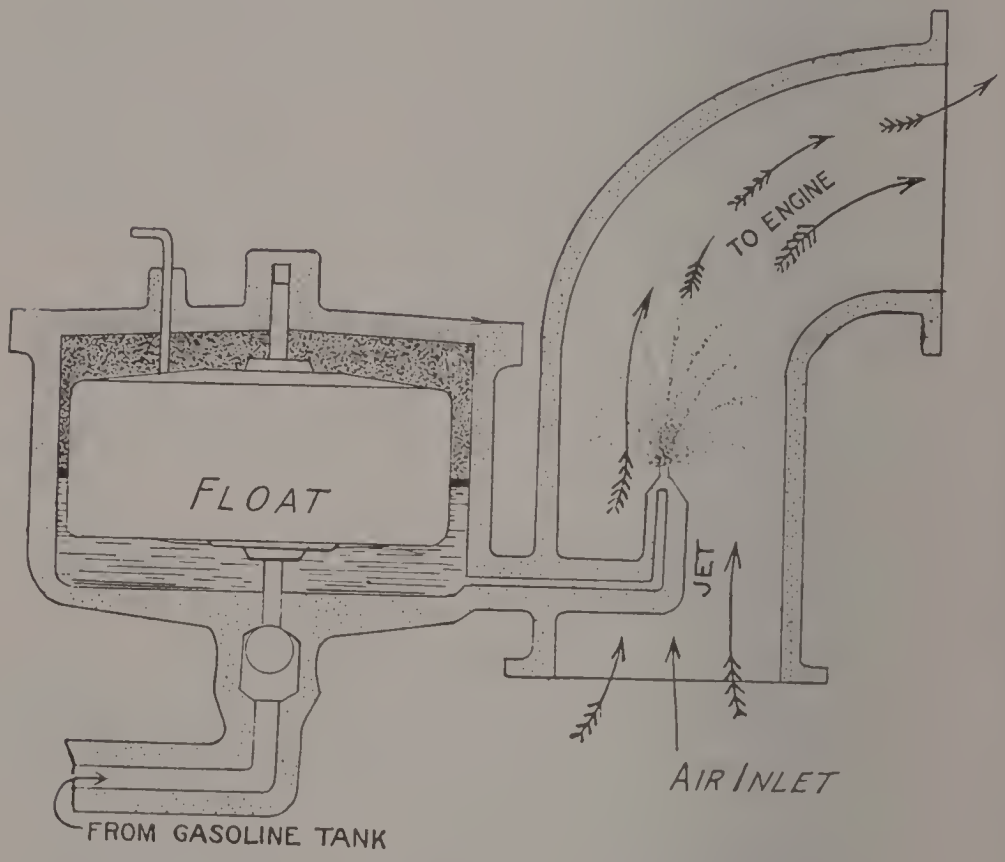
complicated. It is a system of measured fuel supply, which assures a fairly correct mixture at the different speeds, and makes possible the slowest speeds attained so far by internal combustion motors.

The Float-feed Carbureter class contains the largest number of different types, although there is no difference whatever in the basic principle of each, which is to atomize the gasoline so finely as to offer the greatest surface to the air admitted, and to hold the gasoline particles suspended in the air-current sufficiently long to transform them into the explosive gas.

The principal parts of this form of carbureter are the gasoline receptacle, for the reception of the fluid from the fuel tank, and the mixture chamber where the transformation of the gasoline into gas takes place.

The gasoline receptacle contains a thin metal float in the shape of a light, hollow cylinder through the center of which runs a needle valve spindle, pointed at its lower end, which, under normal conditions, keeps the gasoline supply pipe closed, but opens it as soon as the fluid

in the receptacle sinks below its ordinary level. This control is accomplished by means of a suitable arrangement of levers, springs, etc., and has for its object the maintenance of a constant level at a certain point.



CROSS SECTION OF CARBURETER
(OLDSMOBILE)

The mixture chamber contains a jet or spraying nipple, which, at its lower end, communicates by means of a fine hole with the bottom of the gasoline re-

ceptacle. The small amount of fluid thus supplied to the spraying nipple naturally maintains the same level as that in the larger receptacle, and should be about one-sixteenth inch below the mouth of the jet or sprayer.

The atomizing process takes place through the sucking action of the cylinder pistons, which, through the inlet pipe, creates a vacuum above the opening of the nipple and—the distance being small—lifts the gasoline particles therefrom in the shape of a fine spray. This spray meets another current of induced air which vaporizes it immediately and carries the now suitably diluted gaseous mixture to the combustion chamber of the cylinder where it is exploded.

The carbureter is so arranged that it may be flushed at any time for the purpose of starting the motor, or relieved of any surplus quantity of gasoline.

The beginner will do well, after having become theoretically acquainted with the general function of a carbureter, to carefully study the individual carbureter of his car by taking it apart and assembling it again. This will give him knowledge of its single parts, and enable him

to easier locate the troubles to which this delicate apparatus is, perhaps, more subject than any other part of an automobile.

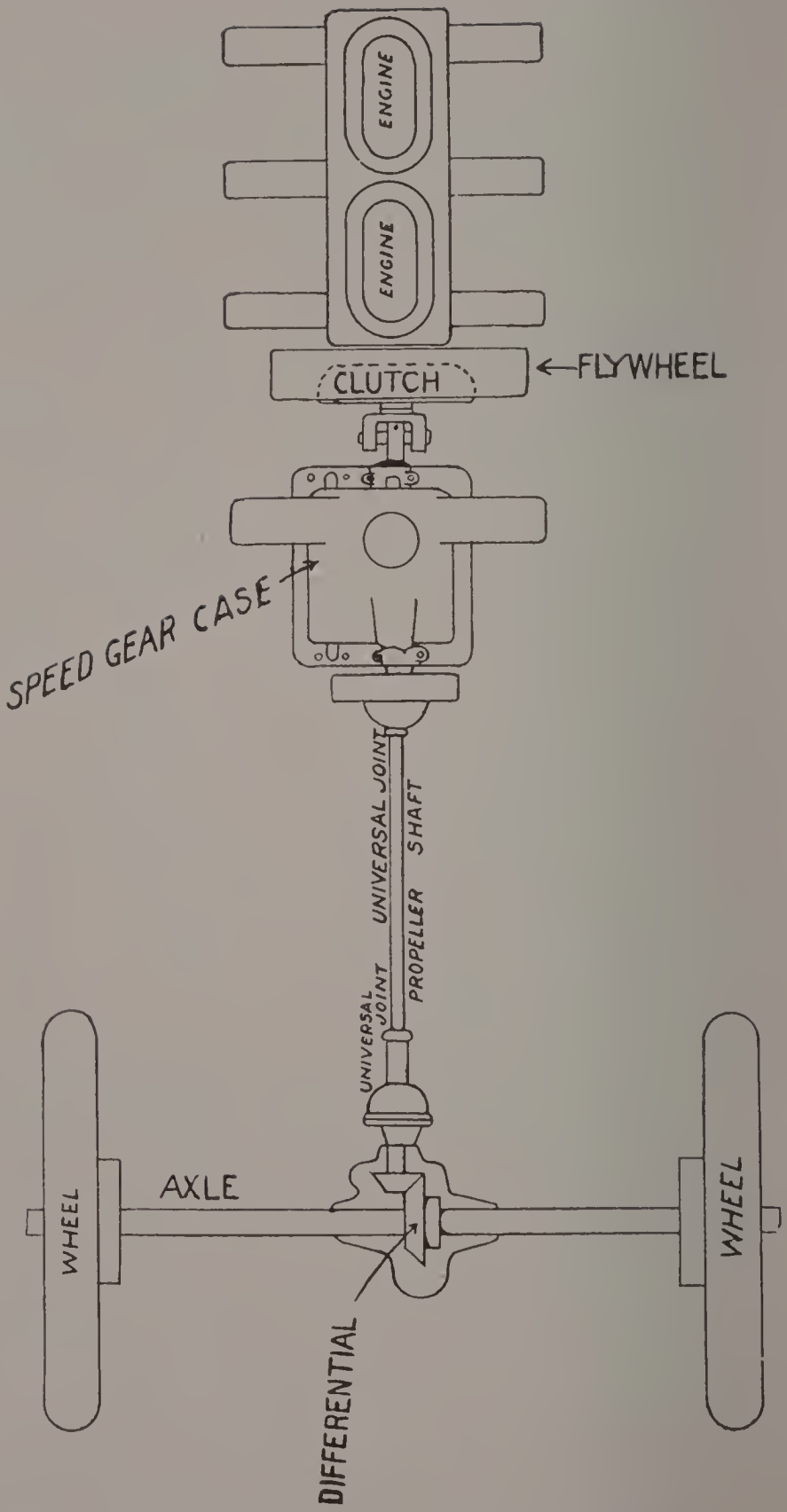
CHAPTER VIII.

THE TRANSMISSION.

The term "Transmission" is ambiguously used by most motorists. It is variously applied to different parts of the mechanism for transferring the engine power to the road wheels, such as the universal or cardan drive shaft, the chain and sprocket wheels, the change gear, etc. The application of the term in its true meaning, however, includes the whole mechanical apparatus of transmitting the power, developed by the motor, to the driving wheels by means of shafts, gears, pinions, bevel wheels, chains, friction plates, etc., as the special system of car construction may demand.

The disposition and general mechanical arrangement of the transmission depends on the general lines on which a motor car is built, but since there are too many systems in use, the two principal types only shall be gone into in order to give the novice a general idea as to the working of the mechanism.

Before doing this, a few preliminary



CARDAN SHAFT TRANSMISSION.

remarks, which will materially aid in the understanding of the subject, will not prove without some value.

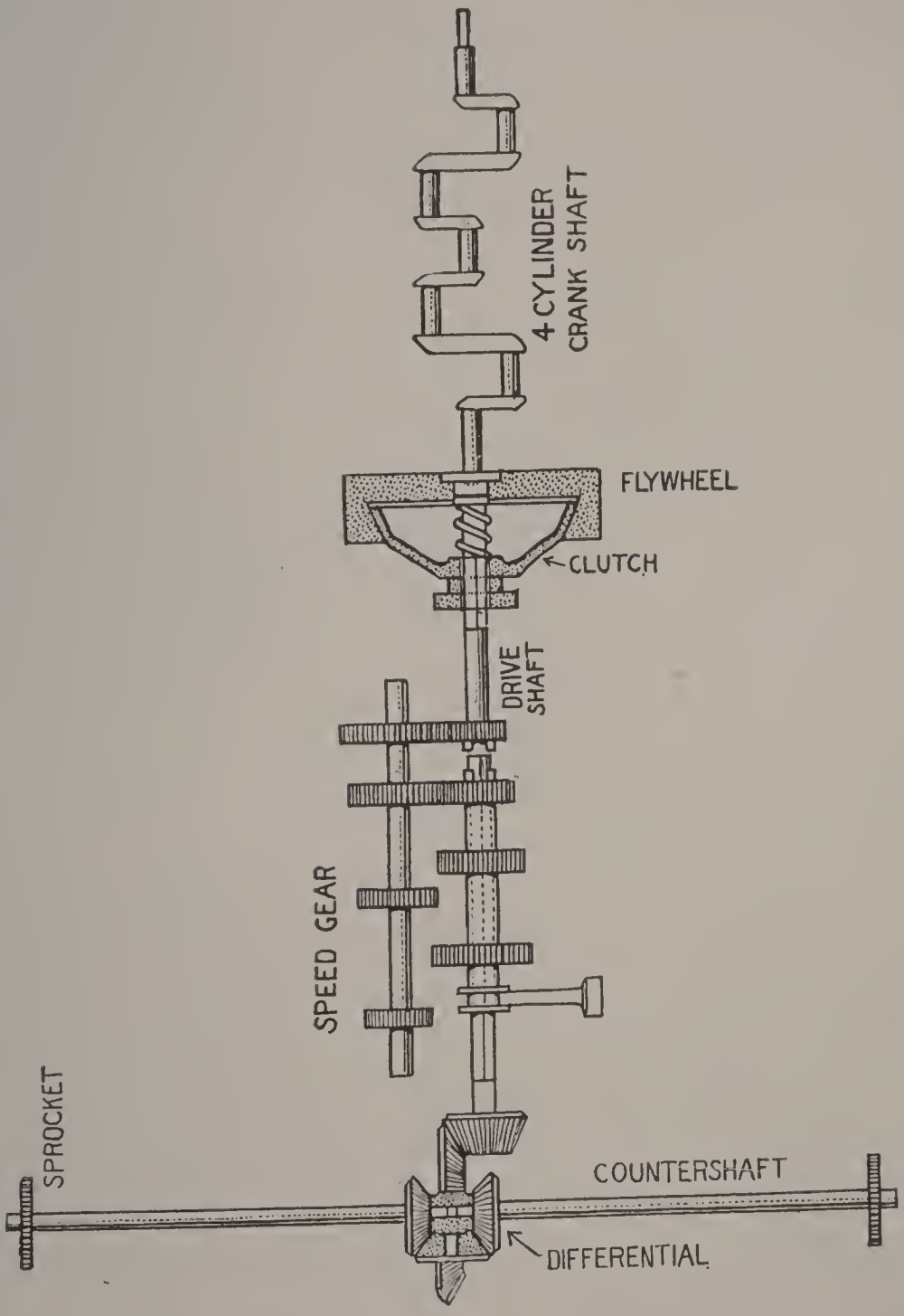
It is obvious that an automobile must be able to be driven at various speeds, and that a uniform rate only would be impracticable. Electric and even steam motors possess sufficient innate elasticity to accomplish this without the aid of a speed changing device, although the latter is often assisted by such an arrangement. In the gasoline engine, however, a change of speed can only be effected by modifying its power, a process which materially reduces its efficiency. Electric and steam motors also have the advantage of being able to run backwards by the simple manipulation of a controller or valve gear, while the gasoline engine is incapable of reverse motion. It is essential, therefore, to provide in connection with the latter a transmission which includes a change gear and a mechanical device for reversing.

Since the starting of the gasoline motor, whether by hand or otherwise, can only be effected when it is disengaged from the transmission mechanism, it is further necessary to have an

apparatus for connecting and disconnecting the power at will. This apparatus, called the Clutch or Friction Clutch, also comes in use when an abrupt stopping of the car is imperative, as the application of the brakes can only be effective if the propelling motion is stopped. The gasoline engine, being incapable of reverse action, it follows, that in order to arrest the forward movement of the car, the motor has to be thrown out of gear, or, in other words, disconnected from the driving mechanism. The engine should also be disconnected when going on a down-grade at great speed on the gravitation of the car, as otherwise the speed of the wheel revolutions would be retarded by the motor at the risk of damaging the mechanism.

Another point which has to be taken in consideration in the transmission is the independence of the two rear or driving wheels from each other in regard to turning corners. This independence is achieved by means of the differential gear which is spoken of under a separate heading.

The two principal systems of transmission mentioned above are the Chain



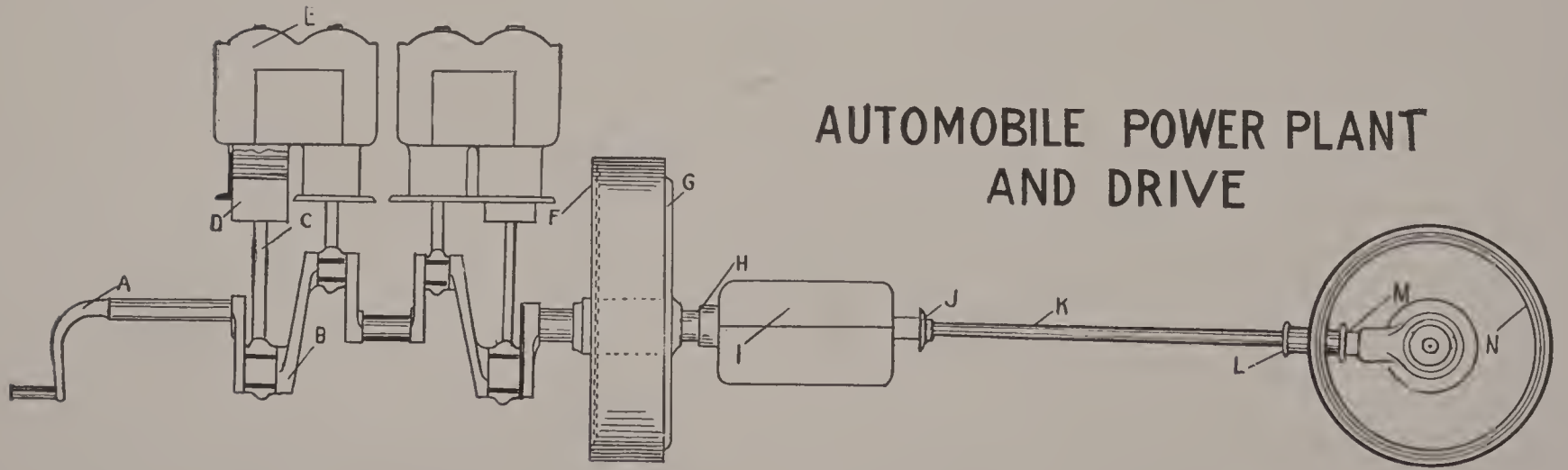
CHAIN TRANSMISSION.

and the Universal Driving or Cardan Shaft Transmission. There is no difference between the two so far as the mechanical arrangement between the motor proper and the case containing the change speed gears is concerned. This arrangement in the car of the most popular type, having the engine placed in front, is the following in both systems:

The end of the motor crank-shaft bears the heavy fly-wheel, within which, the friction clutch is arranged. The clutch is connected, in direct line, by a shaft with the change speed gear in its case and, through it, with the part of the transmission mechanism where the difference between the two systems mentioned begins.

In the chain system, the power is transferred here to a transversal counter-shaft, within the gear case, which is driven by a bevel gear mounted on the differential box. The counter-shaft terminates at both ends in strongly attached sprockets from where endless chains transmit the power to larger chain-wheels which are securely bolted to the driving wheels set on a solid stationary axle. The chain transmission is principally used on the heavy touring and racing cars.

AUTOMOBILE POWER PLANT AND DRIVE



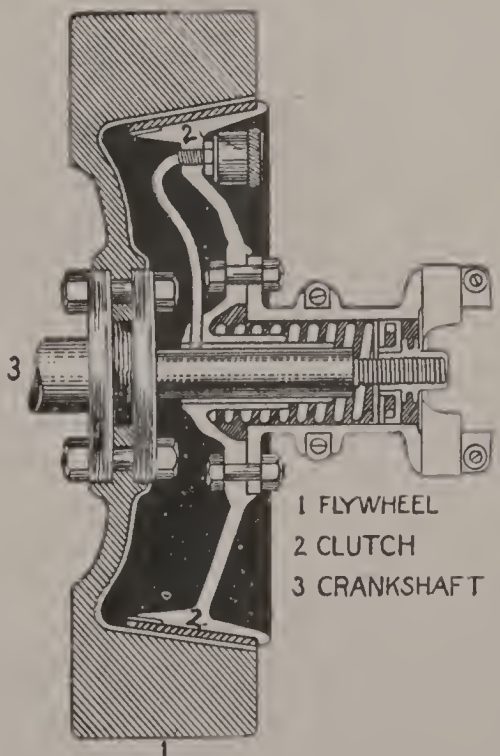
A Starting Crank.
B Crank Shaft.
C Connecting Rod.
D Piston with Rings.
E Cylinder.
F Fly Wheel.
G Clutch.
H Universal Coupling.
I Gear-change Mechanism.
J Universal Joint.
K Drive Shaft.
L Universal Joint.
M Housing enclosing Driving Gears and Differential Mechanism.
N Drive Wheel

In the cardan system, the secondary shaft from the gear case is attached to a fork which is connected by means of a universal joint to the longitudinally placed driving shaft. The other end of this shaft is connected with a second fork and universal joint mounted on the bevel wheel shaft. This double universal connection becomes necessary in order to secure more flexibility, and on account of the motion caused by the springs which attach the chassis to the axle. The large bevel wheel finds its place on the outside of the differential box, and the whole is enclosed in a casing with extensions which form the bearings for the live or rotating axle on which the driving wheels run.

CHAPTER IX.

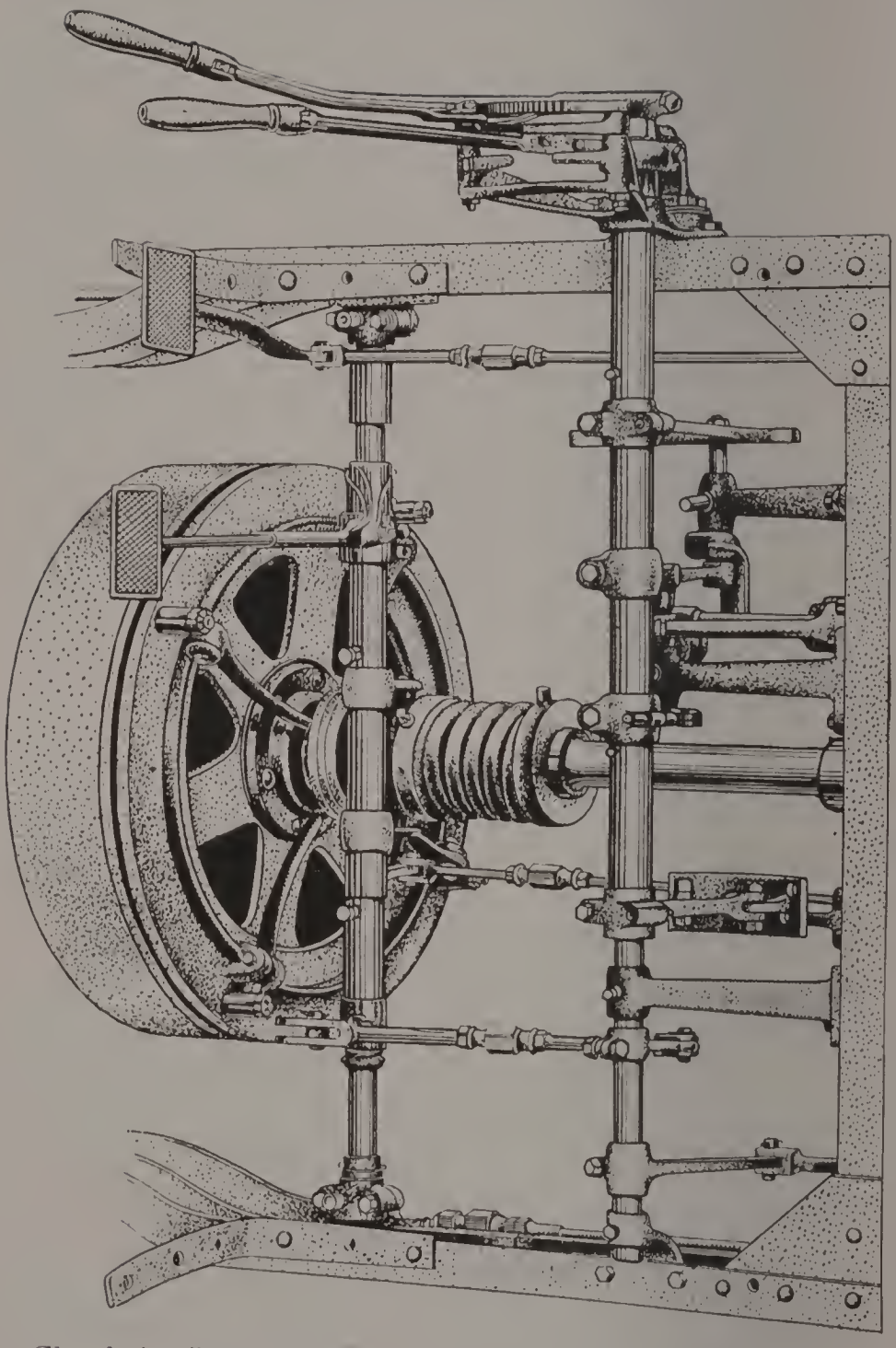
THE CLUTCH.

The clutch in an automobile, being most generally placed behind the motor, between the crank-shaft and the system of transmission, may be described as a mechanical arrangement for temporarily connecting the engine or crank-shaft with the driving shaft, which lie in the same plane, in a manner that they may be driven together.



CONE CLUTCH

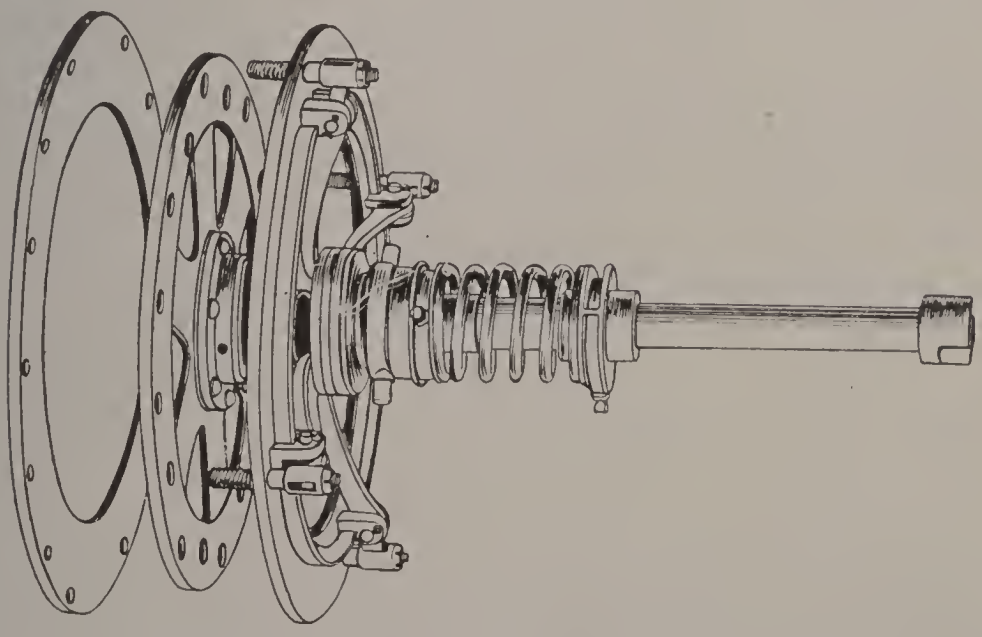
Clutches, in general, are of too many types to even attempt an elaboration, and since it is the Friction Clutch system which is most widely used in connection with automobiles, the beginner can profit most by concentrating his first attention on them. Even in this class there are a number of varieties,



Clutch in Operating Position. Foot Pedals, Levers and Anti-Gear Stripping Device (Thomas).

chief among which are Cone Friction, Contracting or External Band, Disk, Internal Expanding Ring and Coil clutches, but whatever the mechanical means employed in the various types may be, the name indicates that the connection between motor and transmission system, effected by them, has to be made by means of friction.

By far the most popular type of the friction clutch system is the Cone



THREE-DISK METALLIC CLUTCH (Thomas).

Clutch. In this method, the flywheel of the engine is almost invariably employed as part of the mechanism. Its hub shell, which forms the so-called female part of the clutch, is made to receive a leather-faced metal cone (the male part) which

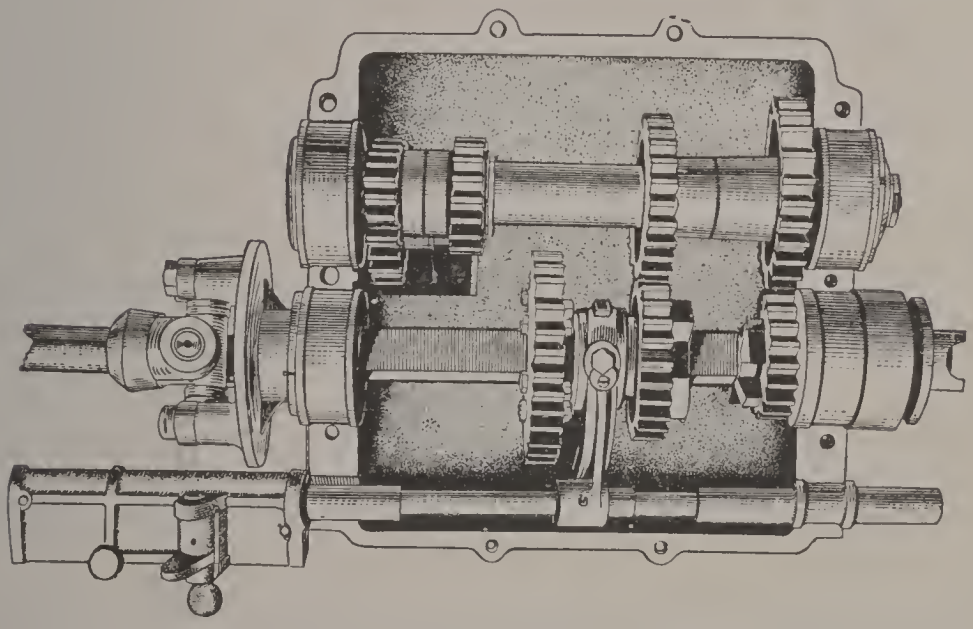
is attached to the driving shaft and is normally held in position by the pressure of powerful springs. It is by means of this male cone which, through a foot pedal, can be made to engage and disengage the female part of the clutch at will, that connections and disconnections between the engine and driving shaft are effected.

The working of the clutch is exceedingly simple. When the leather-faced cone is forced into the shell of the flywheel hub by the mechanical means provided, the contact becomes so close that it takes up the rotation of the crankshaft and flywheel and communicates it to the driving shaft to which it is attached. The latter, on its part, transmits the power again to the general transmission system.

CHAPTER X.

THE CHANGE SPEED GEAR.

Under the heading "Transmission," the reasons have shortly been stated why a gasoline engine has to be provided with mechanical devices for changing the



INTERIOR OF SPEED GEAR CASE (Pierce Great Arrow)

speed of a car. These devices are of many varieties, more or less simple or complicated, but the mechanical principles by which the object of changing speed may be achieved are but few in number. They may be broadly classified in four distinct methods of action, the most practical and widely used of which

is the so-called Sliding Gear, the earliest form of which constitutes the noted original Panhard & Levassor speed change gear which is now employed, with many modifications, by the best motor car manufacturers.

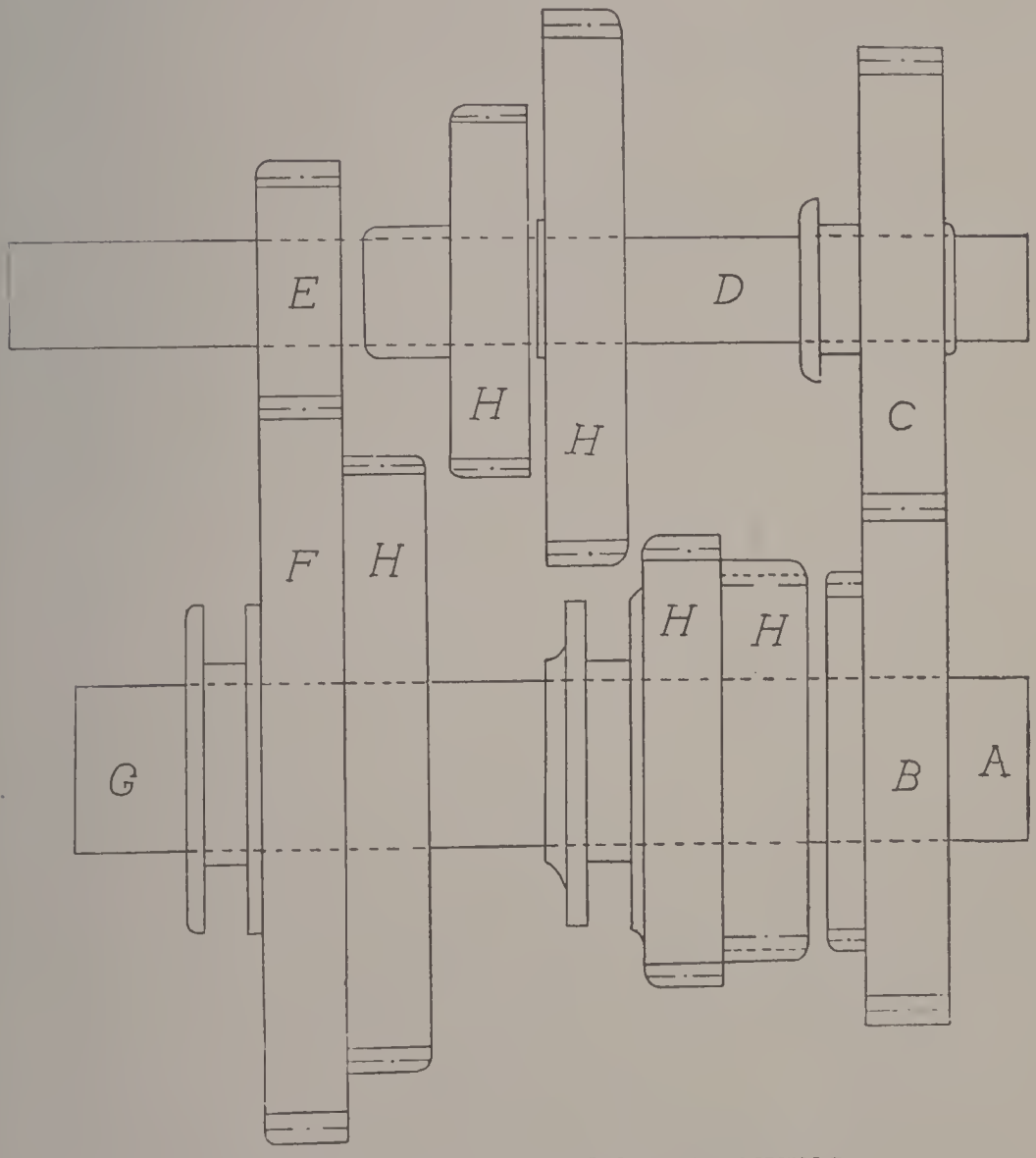
As the name indicates, the principle of this gear consists of obtaining the speed changes by sliding gear wheels of various diameter, either on a sleeve or separately, in and out of mesh.

Another method is the Expanding Clutch Gear in which either expanding, friction or dog clutches act on constantly meshing gear wheels. While not as popular as the sliding gear, this principle is employed by some good manufacturers, notably in a well-known French make.

The Planetary or Epicyclic Gear varies much in arrangement, but the general principle consists of the speed changes being obtained by the clutching and releasing of the working parts, thus making them active or stationary. The arrangement of the gear wheels in this method may be likened to the motion of the sun and planets, and the system derives its name from this resemblance.

The fourth method of mechanical

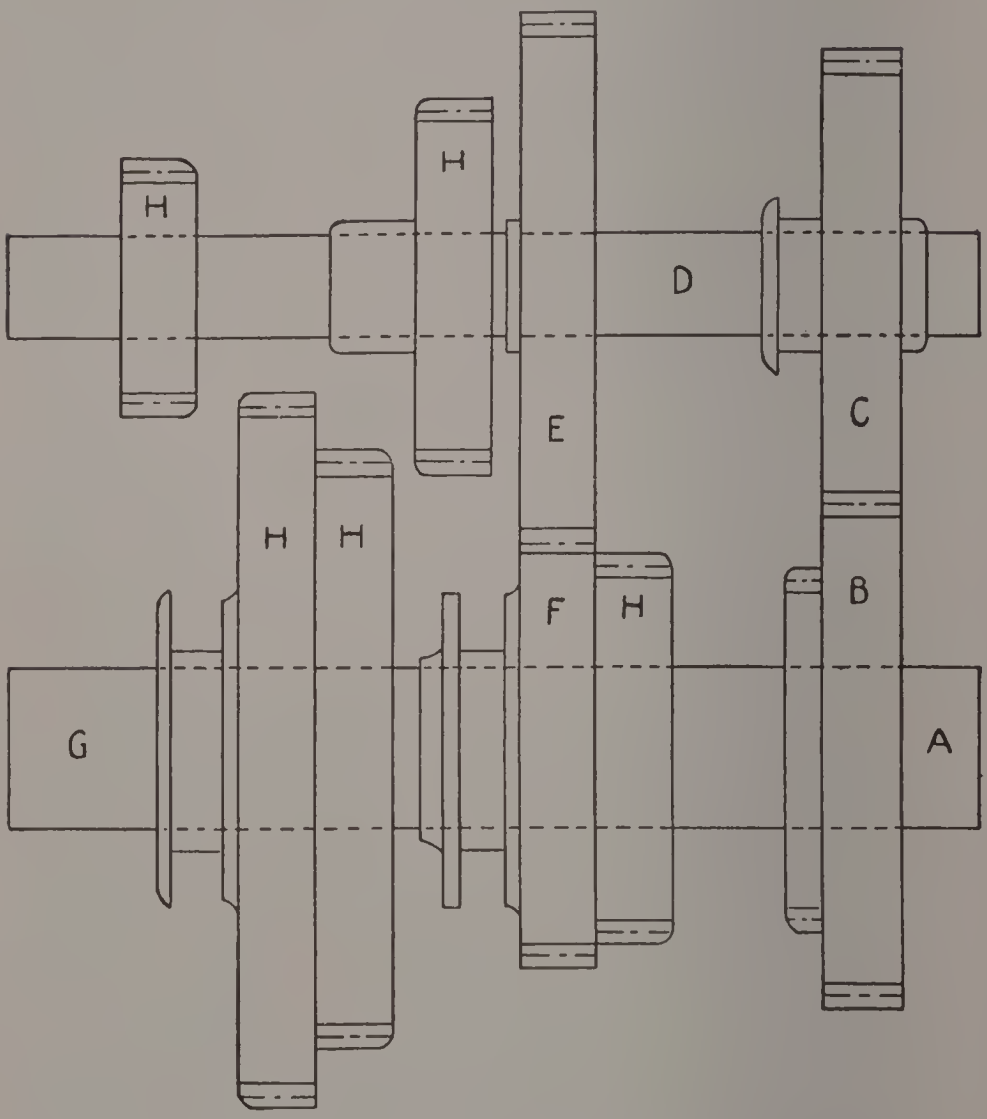
speed change is nearly obsolete. It is generally designated as the Sliding Feather Gear, and in it the constantly meshed



GEAR-CHANGE MECHANISM SHOWING LOW SPEED ENGAGED.

A, Forward part of main shaft: B, Gear on forward part of main shaft engaged with gear (C) on counter shaft (D); E, Counter shaft gear engaged with gear (F) on rear part of main shaft (G); H, Gears not in engagement.

gear wheels run loose on their shafts. A sliding feather by means of which any desired wheel may be locked to the shaft determines which two wheels in the gear case transmit the power.



GEAR-CHANGE MECHANISM, SHOWING HIGHEST SPEED ENGAGED.

A, Forward part of main shaft; B, Gear engaging with gear (C) on counter shaft (E); F, Counter-shaft gear engaged with gear (G) on rear part of main shaft (H); I, Gears not in engagement.

A simple form of the sliding gear system for a chain-drive car consists of two shafts enclosed in the tight oil-filled gear case. One of these shafts, on which are rigidly mounted a number of gear wheels incapable of any lateral movement, is the one which is driven directly from the motor by means of the friction clutch, and is called the main or primary shaft. The other one receives its motion by a gear arrangement from the first, and forms the secondary shaft. A part of this is square, and on this portion a sliding sleeve is arranged to which a number of wheels of increasing diameter, corresponding with the number of speeds of the car, are bolted in concentric fashion. These wheels are spaced so that only one at a time may be slid into mesh. The sliding sleeve is operated by a fork by means of which it may be pushed along the shaft and the various wheels engaged on which the different ratio of the shaft revolutions and speed depends.

In a speed change gear of this description, the power is transmitted to the driving wheels from the secondary shaft through a bevel gear and counter-shaft, while in a cardan-drive car, where the

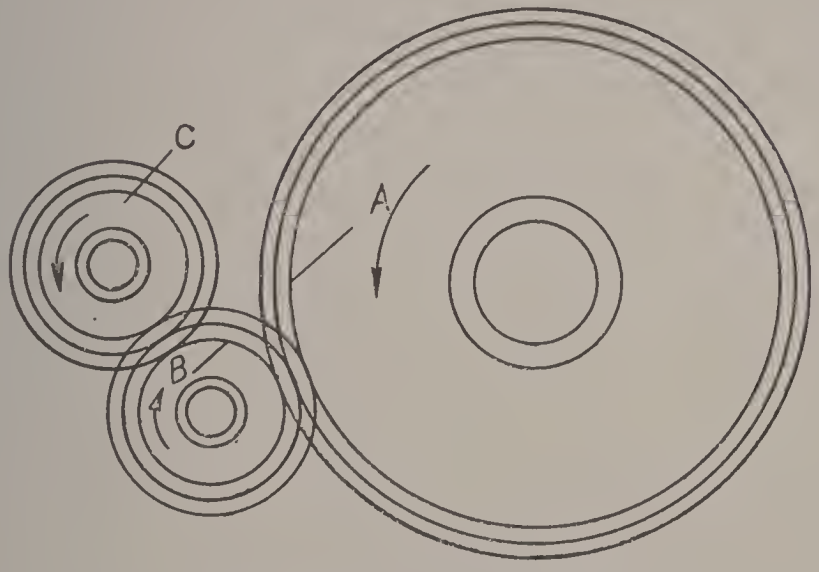
driving wheels get the power through a longitudinal universal joint shaft, the arrangement of the speed change gear is modified by the different construction.

It is, perhaps, needless to say that in changing from one speed to the other, the friction clutch ought to be disengaged, as otherwise the change would have to be effected under pressure and the gears would be subject to considerable wear.

CHAPTER XI.

THE REVERSING GEAR.

Although some inventors have succeeded in constructing internal combustion engines with reversing ability, they



REVERSE MECHANISM.
A, Main shaft gear; B, Intermediate Reverse Idler.
C, Counter-shaft gear.

are so complicated that they have hardly a chance to affect the use of mechanical devices for the purpose.

In one of the two methods usually employed in constructing a reverse mechanism, two stationary gear wheels are mounted opposite each other on the speed gear shafts in the gear case, without, however, coming into mesh during the

forward movement of the car. Only when the reverse lever is actuated do they come into play by both meshing with a third wheel, which engagement reverses the opposite motion of the two shafts, and causes them to revolve in the same direction. This arrangement is based on the principle that when two wheels mesh they revolve in opposite directions, but when a third one is meshed between the two the outer ones travel only one way.

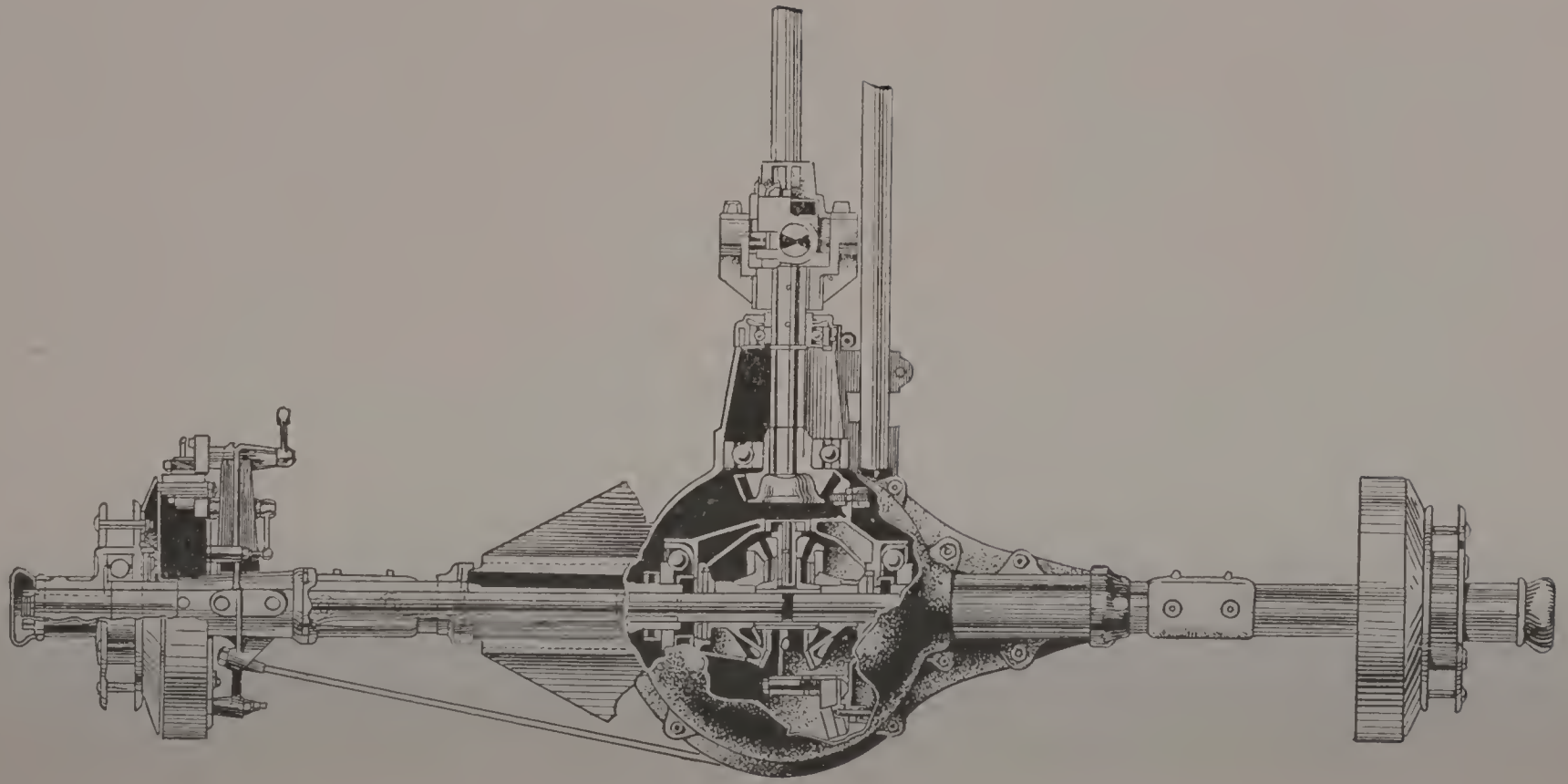
In the second arrangement, a bevel gear wheel is fixed on the driven speed shaft in a way that it can mesh rectangularly on either side with one or the other of two wheels of the same description, which results in the reversing effect.

CHAPTER XII.

THE DIFFERENTIAL.

The object of the differential in an automobile is to effect the revolution of both rear or driving wheels, making it at the same time possible to move one wheel at a greater rate of speed than the other. It is obvious that in making a turn, the wheels of a car revolve at different speeds. But while the front wheels, being mounted independently, adapt themselves to the speed required, the rear wheels, which take up the driving power from the motor and have to act jointly, could not do so were they mounted on a rigid axle, as, in making a turn, the outside wheel has to travel a much greater distance than the inner one.

To balance this difference in speed, the differential becomes necessary, and for the purpose the driving axle is made in two portions which are joined together by a suitable gear, and is thus made flexible. The mechanism is enclosed in an oil-tight case to protect it from the dirt of the road, and is mounted in chain-driven cars on the counter-shaft; in cardan-driven cars on the rear axle.



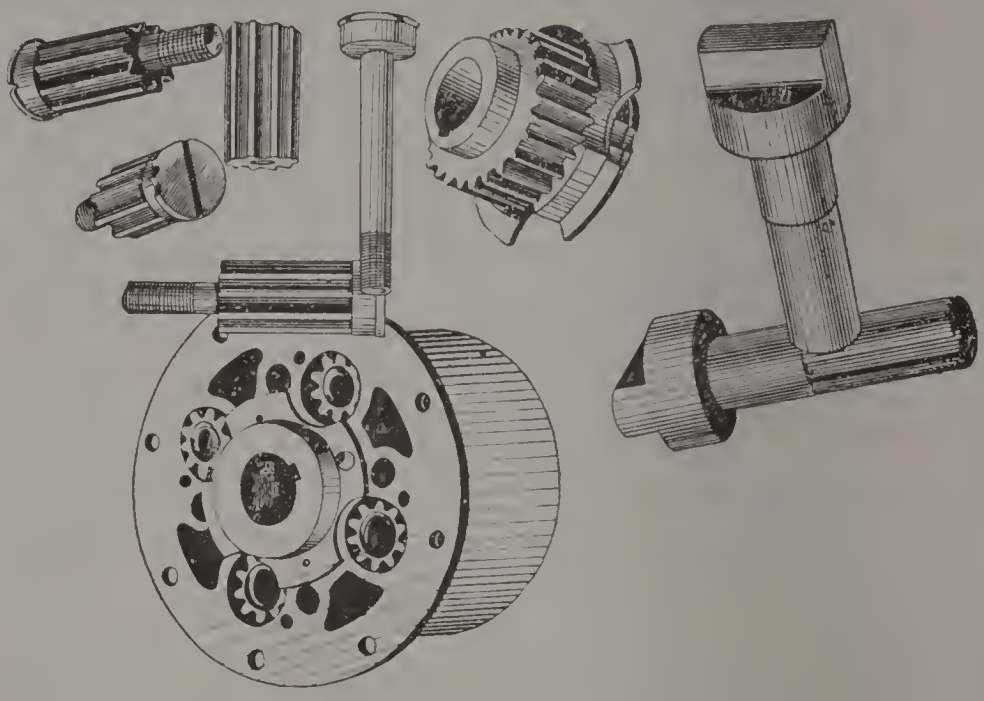
DIFFERENTIAL (Cadillac).

Not all experts are agreed on the absolute necessity of a differential which is a rather sensitive mechanism, and often comes in unrequired action when, for example, one of the wheels strikes an obstacle. On the whole, however, most manufacturers are convinced of its necessity, and there are few modern cars without it.

Among the various differential constructions, the bevel gear and spur gear types are the most common. The action of an ordinary example of the first, which is the more widely used, may be shortly described as follows:

The load on both sides of the bevel pinions of the mechanism being constant, the whole apparatus turns solidly without relative motion when the casing is set in rotation; but as soon as this balance is disturbed by the load on one wheel-set of the mechanism becoming heavier, or if, for some reason, they start to move faster than the other, then a revolution of an equalizing set of pinions follows with sufficient speed to compensate for the difference in velocity, and the entire power is transmitted to the wheel offering the smallest resistance to rotation.

The action of a spur gear differential is the same as that of a bevel gear, but



DIFFERENTIAL, KNOCKED DOWN (Thomas).

the arrangement of the mechanism is different. Two spur wheels are fixed to the two ends of the divided axle shaft meeting each other in the gear case. One of these is an ordinary spur wheel, while the other is toothed internally. A ring with three small pinions takes the drive from the motor. These pinions mesh with the internally toothed wheel on one shaft end and with the regular spur wheel on the other.

CHAPTER XIII

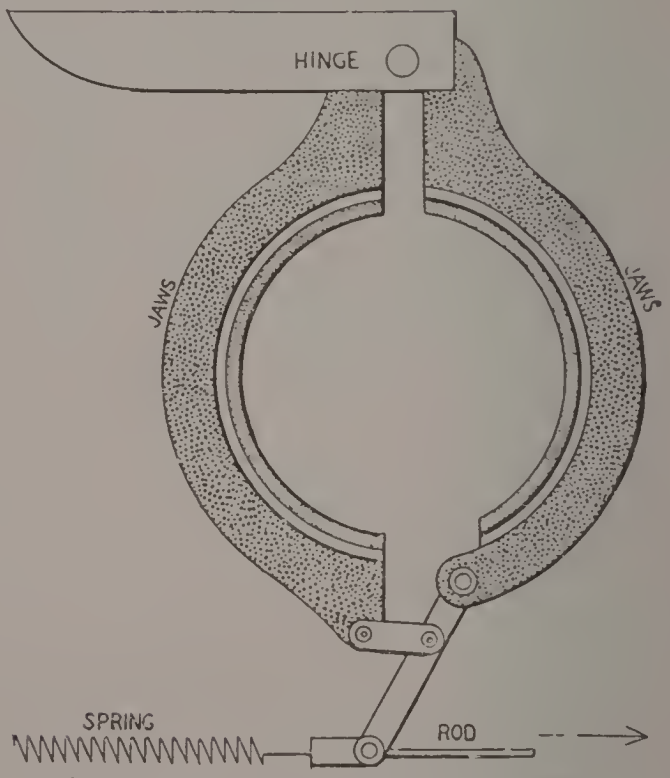
THE BRAKE.

A brake, in the general sense of the word, is an apparatus for reducing or altogether checking the motion of a vehicle or any moving part of it. It is an absolutely necessary mechanism in an automobile where acquired speed in connection with the emergencies of the road make a sudden stop often imperative. The mechanism itself may be attached to various parts of the car which impart motion, such as the transmission, the wheel hubs or the tires (the latter method is obsolete on account of undue wear), but the foot pedal or hand lever which actuates it is always placed conveniently for the driver to bring it easily into play.

Brake systems do not show a great variety, being principally confined to band brakes of different construction. Hydraulic and pneumatic brakes have not proven a success, and electric brakes are invariably employed in automobiles of that description.

The simplest band brake consists of a flexible steel band, which is often lined

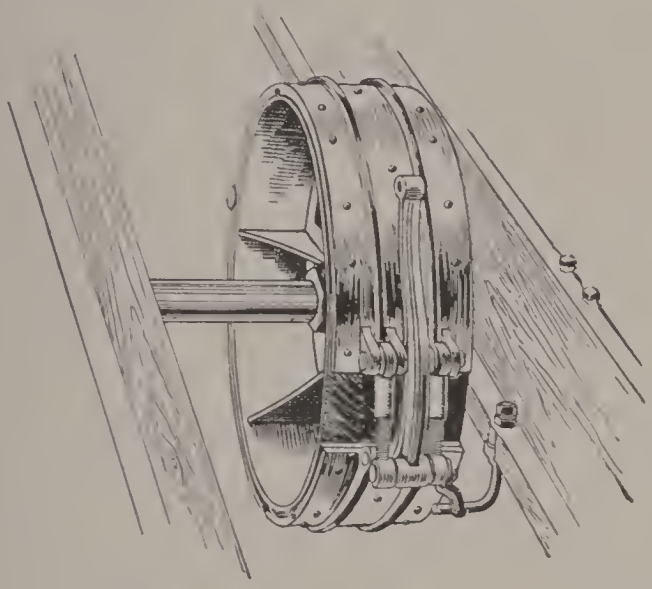
with a suitable substance, such as leather, fiber or copper, in order to increase its gripping quality, and is placed around a brake drum. The contraction of this steel band, effected by a system of levers, causes the retarding friction which



KREBS DOUBLE-ACTING BRAKE.

checks the forward momentum of the car. This style of brake is not practical, however, for stopping a reverse movement, as an attempt in that direction results in the release of the tension of the brake band and jerks the control from the operator.

A considerable improvement on this style are the double acting band brakes of external or internal friction type in which the braking difficulty in the reverse movement is entirely done away with. In an effective pattern of this



RUNNING BRAKE (Locomobile).

kind, the steel band is replaced by two hinged metal clips lying around the brake drum. The pivot of the hinge is fixed to the car, and the brake acts by the two clips being contracted on the brake drum.

Internal band brakes are of the expansion type, are usually encased, and work on the inner surface of brake drums fixed to the road wheels. They are very effective, reliable and largely in use.

CHAPTER XIV

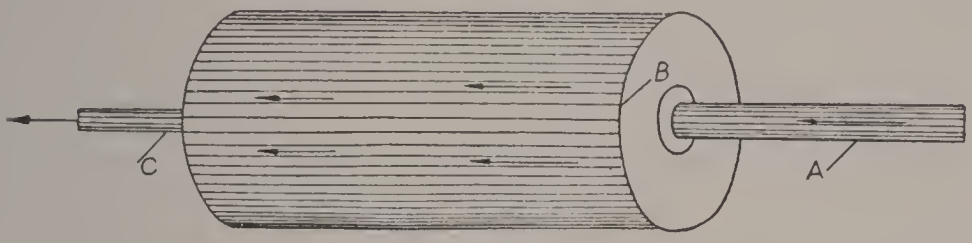
THE MUFFLER.

It has been pointed out under the heading "The Gasoline Motor" that the exhaust stroke of the cylinder piston forces the burned gases from the combustion chamber. The explosion and sudden expansion of these gases at the opening of the exhaust pipe cause considerable noise, to subdue which, is the object of the muffler or silencer. The purpose is accomplished by a metal chamber of large dimensions, attached under the car, into which the gases are led by means of the exhaust pipe, and where they are allowed to expand and cool before escaping into the air.

In their passage through the muffler, the gases are forced into a series of compartments consisting of perforated plates or light metal tubes, thus being divided into a large number of fine jets, which at their exit have barely more than atmospheric pressure, and cause the puffing, but much reduced noise at the mouth of the silencing chamber. This mouth should be in a position so as not to dis-

turb the dust of the road by the blow from it.

The size of the muffler, as well as the perforations of tubes and plates dividing the compartments, ought to corre-



MUFFLER.

A, Inlet from Cylinders for Exhaust; B, Muffler: C, Exhaust Outlet from Muffler.

spond with the horse-power of the car in order to give the best service, and in large machines sometimes two or more of them are employed in series. To more effectually deaden the noises, which may be caused by the resonance of the metal chambers, layers of asbestos frequently are used.

There is still room for improvement in this adjunct of an automobile, noiseless running being the desideratum of all motorists.

CHAPTER XV

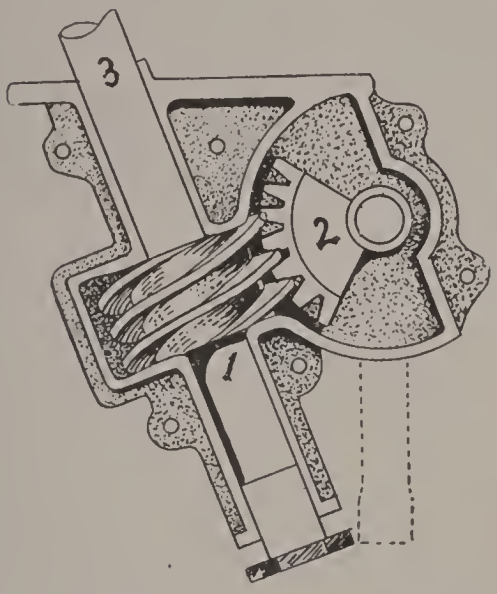
THE STEERING APPARATUS.

Among the three steering devices used in automobile construction, wheel-steering predominates by far, and is used in all the heavier and better types of gasoline and steam cars. Lever and side-bar-steering are principally used on lighter gasoline and electric machines, but are gradually losing in favor.

A wheel-steering device generally consists of a worm gear or endless screw which meshes with a quadrant or section of a toothed wheel. The screw forms the lower end of the more or less inclined steering-column, which bears at its head the steering-wheel. The quadrant is mounted on a steering-arm, which is connected through a lever with the steering-rods and front wheels. Screw and quadrant are, as a rule, enclosed in an oil-tight case.

The action takes place by a turn of the steering-wheel to the right or left, which transmits the motion to the worm-screw at the end of the steering-column, and causes a corresponding movement of the

meshed teeth of the quadrant. The power is thence transferred to the rods and wheels, the deviation of the latter



1 WORM 2 SECTOR
3 STEERING COLUMN

from the straight direction depending on the smaller or larger radius of the turn given the steering-wheel by the driver.

In this system, however, the wear on the worm-gear and quadrant will, in time, cause back-lash, and another mechanism, the screw and adjustable-nut-design, in which the play can be taken up whenever needed, has an advantage in this respect. Both of these designs belong to the irreversible type of steering mechanisms in which a locking device prevents any chance movement of

the steering-wheel by a motion of the front wheels.

The pinion and rack and pinion and quadrant steering mechanisms are of the reversible type, but it takes quite a considerable movement of the front road wheels to affect the steering-wheel, on account of the reduction of motion between the two.

CHAPTER XVI

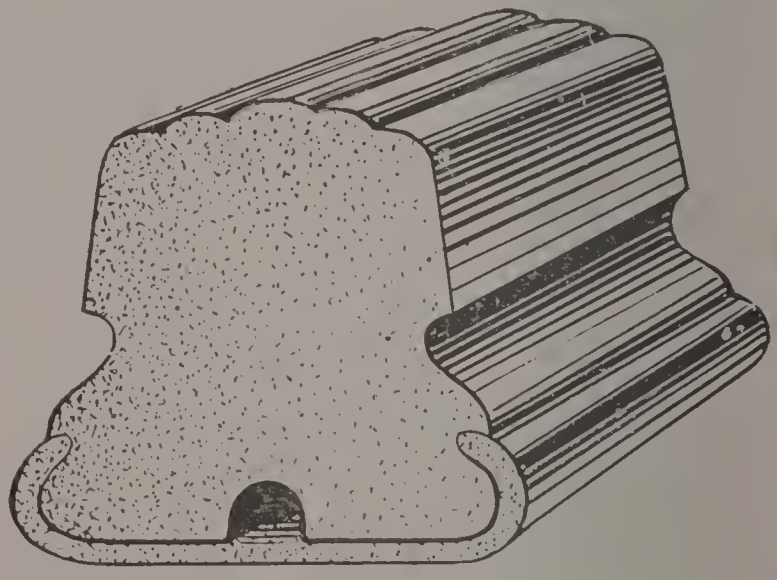
THE TIRES.

The riding quality of an automobile depends, to a large extent, on the rubber tires, and it is the aim of tire manufacturers to combine durability and resiliency with the safest method of attachment in order to achieve that result. Efforts have been made by inventors of wheels, with a system of springs or other absorbers of vibration, to replace rubber tires, which form a considerable item in the maintenance of a car; but these efforts have, so far, been futile, and the line of improvement in riding comfort lies still in making pneumatic tires more puncture-proof, and their mounting and dismounting less troublesome.

Solid tires, which are more durable and economical have but little resiliency, and their use may be said to be restricted to commercial vehicles. Cushion tires have some advantage over the solid type in resiliency, but have drawbacks in other directions, and, therefore, for pleasure cars the pneumatic tire is the only one which can give relative satisfac-

tion. These conditions would, perhaps, be different if roads were uniformly good.

Of the two forms of pneumatic tires, the single and double-tube, the latter is by far the more popular, principally on account of the greater speed obtainable with it. Single-tubes are, as a rule, only



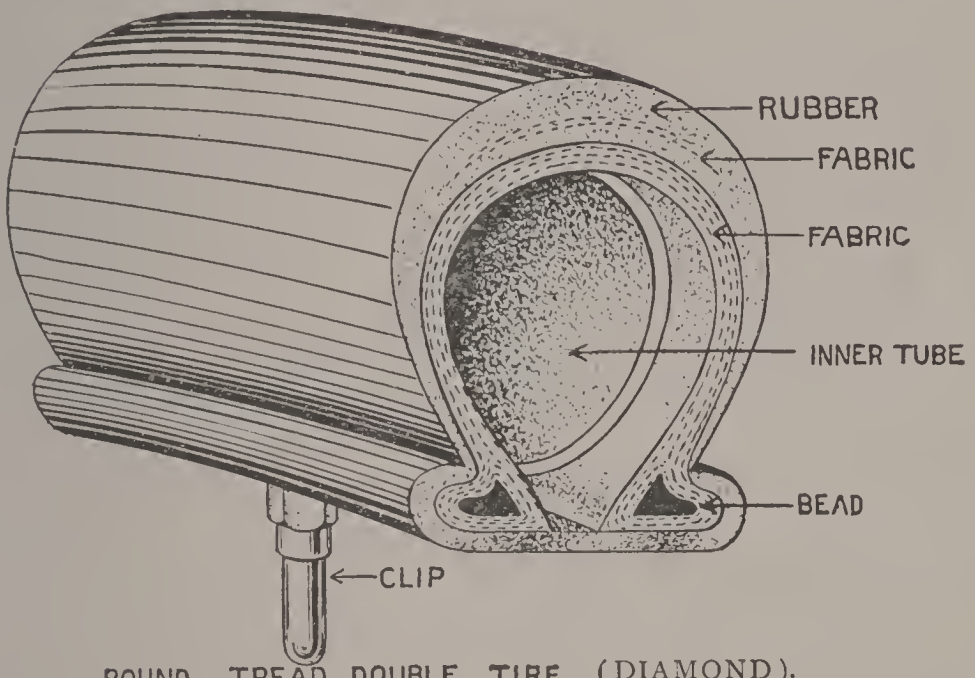
SWINEHART SOLID TIRE

employed on lighter vehicles with moderate speed ability.

The difference between a single and double-tube tire consists in that the air-tube of the first, being vulcanized to the inner surface of the tire, is an integral part of it, while in the double-tube tire the inner tube forms an independent air-chamber which comes in contact with

the outer cover only when inflated. There is a further difference in the method of attachment.

The systems of fastening a double-tube tire to the rim of the wheel are quite

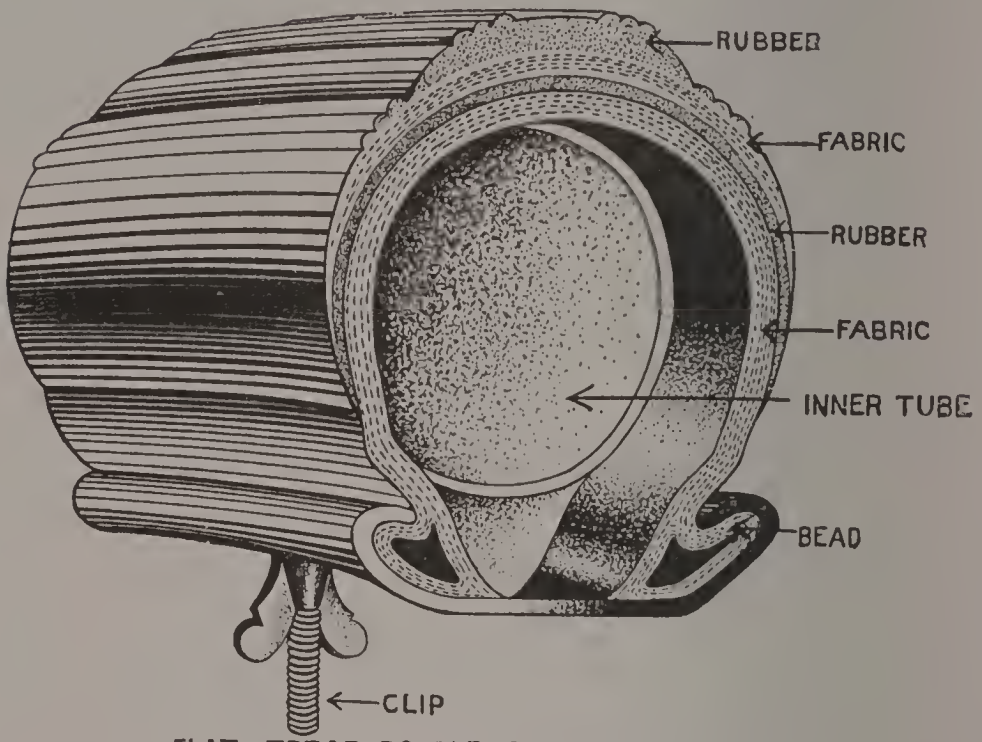


ROUND TREAD DOUBLE TIRE (DIAMOND).

variegated, and on the different methods for security of attachment and ease of handling, depends the efficiency of the tire. The most typical form is the Clincher tire with its many modifications, which is used by the best French, German, English and American manufacturers.

The outer cover of a Clincher tire has so-called beaded edges which, on the tire being mounted and inflated, are tightly

forced by the air pressure into the inturned lips of the rim which hold the tire



FLAT TREAD DOUBLE TUBE TIRE
CONTINENTAL

in position; but, since this fastening alone is not sufficient to resist the tremendous side-pull when making turns at high speed, further mechanical means of strengthening its hold become necessary. This is generally effected by means of clamping bolts, but even these devices, combined with the strength of the Clincher edges, are often insufficient to stand the strain of racing speeds.

The construction of tires is quite a complicated business, and this, together

with the constantly increasing cost of crude rubber, accounts for the high prices. In the best makes, the outer cover of a tire is made of a heavy tread of fine rubber, the thickness of which diminishes towards the sides, and of alternate layers of fabric and rubber which are vulcanized together. For the inner tube, to which the air-valve is attached, only the best quality of rubber is permissible.

To diminish the possibility of slipping or skidding, the tread is often corrugated or shows other projections which give it a rough surface. While this affords some protection, it is, by no means, a preventive, and there are many independent anti-slipping devices in the market. They generally take the form of strong leather bands, studded with metal buttons which are vulcanized to the tread, of similar detachable covers to be laced entirely around the tire, or of metal studs projecting directly from the rubber tread. A simple, effective and, at the same time, cheap anti-slipping device, attachable at will, consists of a smooth metal-chain loosely laid around the tire surface in the form of a wide mesh. This does not cause undue wear

of the tire, and its effect on the speed is quite unappreciable.

As to the method of repairing tires, it may be shortly stated that in double-tubes, after jacking up the car, the outside edge of the cover has to be freed from the lip and the inner tube entirely removed before the damage of a puncture can be effectively remedied. Directions for the process are found in every tire repair kit. If the puncture is insignificant, it may, in an emergency case, be fixed by inserting and cementing in it a rivet-shaped rubber patch, such as is used in the single-tube repairs. Sometimes, if the distance afterward to be covered is not too great, even a tight cement bandage will suffice for temporary repairs.

CHAPTER XVII

THE CARE OF AN AUTOMOBILE.

With the simplification of the mechanism, the introduction of automatic lubrication, and the protection of the machinery against road dirt by means of metal aprons and gear casings, etc., the modern automobile does not give half as much trouble in its care-taking as of yore. Nevertheless, the man who runs his car himself, and wants to do it on an economical basis, will find that it takes considerable attention to keep an automobile in good condition, which is the only way to get proper service out of it. Neither should this attention, in the form of supervision, be omitted in case a chauffeur is employed, as many of these are only too negligent in the care of the vehicles entrusted to them. In both cases an intimate knowledge of the working parts of the machine is a necessity.

Undoubtedly, the most important thing in the preservation of the motor mechanism is the lubrication; but, while a modern automobile, as a rule, has an effective system of automatic oiling for the principal parts of the motor, trans-

mission, etc., there are still numerous components of the car which need personal attention. According to the wear to which the various parts are subjected, they will need more or less attention and a larger or smaller quantity of oil, the quality and consistency of which differs again according to the mechanism on which it is employed. The instruction booklets of the manufacturers give general information on this subject, but practice soon teaches the driver the best medium of lubrication.

It is superfluous to point out that the tanks and oil-tight casings for automatic lubrication of motor and gears should always be kept filled with their proper grease, so as not to need attention during the running of the car, but it is of just as much importance to see that the little nuts, screws, pipes, etc., which form part of the system, are properly looked after, since neglect in this regard often causes trouble.

Less frequent attention is demanded by the clutch and such parts as are included in the running gear system, as axles, hubs, springs, clips, etc., but care of them, at regular intervals, will well repay the trouble. Purely metallic

friction clutches need, however, much more oiling than leather-faced ones. These are kept in good shape by an occasional wiping with a kerosene-soaked rag which removes the road dust. The leather facing should be renewed before it is much worn.

In the case of axles, which are lubricated by consistent grease in oil-tight casings, it is advisable to remove the wheels every six months or so for the purpose of thorough cleansing and re-filling with fresh grease. Hubs, according to the use of the car, may be lubricated every two to four weeks. Springs should always be greased as soon as the slightest squeaking is noticed.

In chain-driven cars, the chain and sprocket need much attention, as gritty mud and dust adhere to them in quantities, and cause considerable wear of the chain links, besides affecting the speed of the car to some extent. The drive chain should always be removed and cleaned after long tours. An hour's soaking, with subsequent washing in kerosene, will remove the dirt, and, after an oil bath, and dripping-off of the superfluous lubricant, the chain is again ready for use.

It is well to remember, in connection with the subject of oiling, that there is such a thing as too much lubrication, and that during the colder season thinner oil may be profitably substituted, in the oil pumps, for a heavier grade.

As to gasoline, this should always be supplied to the tank through some suitable filter, in order to keep out impurities which are apt to clog the fine channels of the carbureter, causing infinite trouble thereby, and in handling this fuel it should never be forgotten that night is not the time for filling a tank, and that a burning pipe, cigar or cigarette are dangerous neighbors. Where a larger quantity of gasoline is kept at hand, it should be stored in an underground reservoir at a safe distance from buildings.

It goes without saying, that the same rule of cleanliness applying to gasoline should apply to the water for the cooling system. Dirty water causes a sediment in the pipes which hinders the circulation. A fine sieve at the point where the water tank is filled will be found of good service. Strongly alkaline water should not be used for cooling purposes, as it leaves a hard deposit on the heated parts of the motor, which is difficult to remove

and causes trouble in the cylinders. The pump connections and other parts of the cooling system need occasional inspection and tightening. Freezing of the water in the apparatus must be prevented by all means, and, during winter, in an unheated garage, the cooling system should be thoroughly drained between use. If no good anti-freezing solution is employed, freezing, during short stops, can be prevented by letting the motor run at slow speed. During long stops it is more economical to drain. Relating to anti-freezing solutions it must be remarked that they tend to corrode, more or less, the metal parts with which they come in contact.

The carbureter, being the seat of much trouble when not perfectly working, should always be kept scrupulously clean, and it is not a bad plan to occasionally take it apart for the purpose.

In the ignition system, constant attention should be paid to perfect contacts, and these points should be cleaned from time to time with kerosene. The spark plugs must be inspected quite frequently as they are apt to get foul, in which case they cause misfiring. When examining them, the points of the sparking wires, if

not at proper distance, may also be re-adjusted. The correct distance is about 1-32 inch. The isolating substance of the wires should be protected against the damaging effect of oil by wiping it off whenever necessary. As to the brakes, they will need an occasional re-adjustment and cleaning of the steel bands.

Tires in use ought to be always well inflated and, if practicable, repaired on the spot in case of puncture, as running a car any distance on a flat tire ruins not only the inner tube, but also the outer cover and is a costly proceeding considering the price of tires.

If the car is out of use for any length of time, such as during the winter, the tires should be inflated only sufficiently to carry the weight, or they may be altogether removed, in which case they should be kept in a dark and moderately cool place.

The car itself, after returning from a dirty drive, should be washed as soon as possible by means of a hose, wiped with a soft sponge, and polished dry with a soft chamois skin or clean waste. The upholstery may, from time to time, be rubbed with a vaseline rag to preserve the pliancy and lustre of the leather.

In general it may be said that it is better to spend the time necessary for the proper care of an automobile shortly after, than just before using it, when, in most cases, the work can be done more leisurely and thoroughly.

In conclusion of the chapter, the motorist may be advised that it is a good plan to keep track of all expenditures in connection with the car, such as fuel, oil, repairs, supplies, etc., as it is a satisfaction to know, at the end of each season, just what the maintenance of the car has cost. If an odometer has been attached to the vehicle, it is then, too, easy to figure out the running cost per mile. "Krausz's Complete Automobile Record" (Laird & Lee, Chicago) will be found the most practical book for this purpose.

CHAPTER XVIII

TROUBLES OF THE ROAD.

Road troubles need have no great terrors for the motorist who keeps his car in good shape and makes sure, before starting on a tour, that every part of the mechanism is in good working order, that nuts, bolts, screws are tightened, lubricating and water tanks are filled, tires in condition, that the wiring is in order, and the strength of the batteries of the proper voltage. An ounce of prevention is better than a pound of cure, and with these precautions road troubles, unless caused by accident, will be reduced to a minimum.

There are, however, unforeseen emergencies which no precaution can prevent, and a complete set of tools with small spare parts and certain supplies are indispensable adjuncts of an automobile before going on an extended trip. For local use it is hardly necessary to encumber the car with such a list as is given here for longer tours, but in general it may be said that it is better to have handy too many tools and accessories than not enough.

The following will be found indispensable for touring:

A jack.
An air pump.
A Stilson wrench.
A monkey wrench.
Various pliers.
A key puller.
A small hammer.
A large hammer.
Set of tire tools.
Various files.
A cold chisel.
Various spanners.
A large and a small screwdriver.
Scissors.
A strong knife.
A funnel with chamois skin lining.
An oil pump.
Tire repair kit.

Among the spare parts several chain links, a valve or two, a couple of spark plugs, 2 inner tubes, a tire casing, and some of the smaller nuts and screws, which are apt to work loose, will be found necessary.

Of instruments, supplies and miscellaneous things, an ammeter, densimeter, an oil can, a spool of wire, a rope, old gloves, goggles, overalls, soap and clean

waste are important accessories to have along.

If trouble in the functions of the motor occurs on the road, the experienced driver will, as a rule, be able to locate it soon, as the various disturbances of the engine have their unmistakable symptoms. To diagnose these takes practice, and theoretical knowledge, gained from books, can only slightly aid the beginner.

The stopping of the motor, or its irregular working in a well-conditioned car may, however, generally be traced to very simple causes, and the novice will, sometimes, save much unnecessary work by ascertaining, before making further inspection, whether the trouble is not caused by lack of gasoline in the fuel tank, or by an insignificant disturbance in the ignition system. The latter is the most fruitful source of trouble, but since ignition disturbances manifest themselves in fitful working of the engine before it stops, this cause of trouble ought to be quickly recognized.

In that case the fault may be looked for in a loose wire connection, caused by some little screw working loose, an exhausted battery, foul spark plugs or in a poor contact of the commutator. If a

short circuit is detected, it may be the result of bad insulation, loose or dirty connections, poor adjustments, defective or moist spark plugs and other minor faults. It is generally indicated by misfiring, explosions, and jerky, sluggish movement of the car.

If a careful examination fails to disclose trouble in the ignition system, then a systematic inspection of the car mechanism has to be started. This should be done in logical sequence, and the working of the engine tried after every adjustment of the part where the seat of the trouble is suspected. In this way much experience may be gained.

Probable causes of trouble, aside from the ignition, may be looked for in the carbureter which may be choked up, flooded, chilled (in cold weather), or contain water, which irregularities are also indicated by the same symptoms of misfiring, explosions and sluggish running of the motor, as in ignition disturbances. Cleaning the parts, emptying or temporarily shutting off the supply, and warming the outer surface of the carbureter are the respective remedies. A pan of hot water will prove effective in the latter case. An open flame should never be used to remove the chill.

Faulty compression manifests itself in waning power of the engine, weak resistance in turning the starting crank, misfiring and hissing sounds. It is caused by faulty valves and piston rings, by leaks at tube connections, broken spark plugs or too thin oil. Entire lack of compression is shown by no resistance whatever at the turning of the crank handle. In this case look for trouble in the valves which may be broken or stuck.

Trouble in the cooling system may be caused by defects and broken or worn parts of the water pump, by choked or leaking pipes, by oil in the pump or radiator, or by wrong proportion between cooling water and cooling surface. These causes result in disturbing the circulation and overheating the engine and are often hard to remove on the road.

Gear troubles generally originate from loose or worn bearings, loose pinions, or a displaced gear case, and may be diagnosed by a clattering noise in the gear case and troublesome changing of speeds.

Unlubricated, loose or too tight bearings are indicated by a squeaking noise, rattling and overheating of the affected parts.

The knocking noise in the engine, which the novice quickly learns to distinguish from the ordinary noises of the motor, is always a sign that something is wrong. As soon as it is heard, an inspection ought to take place. The trouble may not amount to much, but the quicker it is looked after, the better it is. Sometimes it is only want of lubrication, too much advanced firing or an overheated engine. Then again it may be a loose connecting rod or gudgeon pin, worn piston rod bearings or water in the cylinder.

As to tire troubles, they have been touched on in the chapter on Tires, but it may be added here that after repairing an inner tube on the road and mounting it again, care must be taken to do this with the tube slightly inflated, as otherwise it easily gets pinched. In using the mounting tools this danger should always be borne in mind and avoided. It is a good plan to practice tire mounting in the garage, so as to become familiar with the process.

The hints given above will, as a rule, prove useful to the beginner and will suffice, as he is not apt to risk long tours alone before being thoroughly proficient

in the science of motoring, which can be acquired only by deeper study and the lessons of the road as presented from time to time by the troubles turning up during shorter runs. The novice will feel himself all the sooner master of the situation the less he relies on the help of others and the harder he himself tries to solve the problems encountered in running a car.

CHAPTER XIX

THE ART OF DRIVING.

It is supposed that an intelligent man, having had no previous experience with automobiles, will make himself familiar with the various working parts of the motor mechanism before he attempts to drive a car himself. This in order to better reason from cause to effect. It is easy enough to learn to steer an automobile, but unless you know your machine thoroughly, this knowledge alone may not always be sufficient in case of a sudden emergency. Theory alone, however, is not enough. It takes practice, considerable practice, to acquire that nerve and rapidity of judgment which the motorist is often called upon to display, especially when driving in the crowded thoroughfares of a city, and what is said in this chapter is, therefore, only intended to serve as a useful hint to beginners.

Let us suppose you are in the act of starting for a drive, after you have imbibed some theoretical knowledge. You will do well to convince yourself, in the first place, that gasoline and water tanks are filled, carbureter connections and oil

pumps open, all not automatically lubricated parts well greased, that the ignition apparatus is in good order, and the tires are properly inflated. Also see that the engine is out of gear, brakes and levers are working properly, and, in general, everything in tip-top shape.

After satisfactory inspection, step to the front of the car to start the motor, but not before you have turned on the switch for the ignition, and retarded the spark lever to proper position in order to avoid back-fire and a consequent kick from the starting crank. In starting the motor of a light car, it is best to give the starting crank, after having pushed it tightly against the crankshaft, a few swift turns which, under ordinary conditions, will put the engine in motion. In high-powered cars considerable effort is necessary to force the crank over the compression, and it is advisable to use the power of the flywheel for the purpose. This is done by pulling the starting crank towards you, and letting it go again. If this is repeated several times, it will be found that the stored energy in the flywheel, with the further aid of a strong pull, is sufficient to start the engine going.

The motor being in motion, see whether oil pumps are acting, take your seat behind the steering wheel, and place, with one hand on it, the front wheels in straight direction. Release hand brake. Put the speed lever to first speed notch and, simultaneously, by depressing the proper foot lever, let in the clutch as gradually as possible in order to avoid a jerk. This will slowly start the car.

It becomes necessary now to watch how the manipulation of the steering wheel affects the direction of the car, and for that purpose keep going at slow speed, without changing the position of the spark lever and throttle from that in which they were at the starting of the motor. Having observed and practiced sufficiently the action of the car in response to the turns of the steering wheel, the spark may be slightly advanced, which will increase the revolutions of the motor and, with it, the speed of the car. It may be observed here that for the practice of driving, a dry straight road should be selected where there is little or no traffic, and that no attempt should be made to change to higher speeds before one feels safe in handling the car on the lower ones.

The change from a lower speed to the next higher one is effected by the simultaneous pressing of the clutch pedal, which releases the clutch grip, and moving of the speed lever from the first to the second, second to the third, or third to the fourth notch, as the case may be. In changing from lower to higher speeds it is well to increase, immediately before doing so, the revolutions of the motor by advancing the spark and retarding it again, as far as possible, at the moment of moving the speed lever.

In connection with this subject, it is well to remember that in going from lower to higher speeds, the speed lever should be moved with a short, quick motion. In the reverse case, the change should take place softly and gradually, and the revolutions of the motor should be diminished immediately before the change. In short, the process of going from a higher to a lower speed is exactly the opposite from that of going from the lower to the higher, described in the previous paragraph.

The reverse gear should never be operated while the car is going at high speed, except in case of impending dan-

ger. In fact, the speed lever should be brought to lowest speed before reversing.

To momentarily diminish speed, the clutch has to be disengaged by depressing the clutch pedal, and to stop, the handbrake should be gradually applied in addition. If the stop is only temporary, the engine may be thrown out of gear, slowed down by means of the accelerator and retarding the spark lever, and allowed to run free. On returning to the garage stop and throw out of gear the motor, shut off gasoline and oil supply, turn off switch and, if necessary on account of coldness, drain the cooling system.

The beginner is especially warned to restrict himself during his early practice, even in a lighter car, to the first two speeds, and to withstand the temptation of not allowing other motorists to overtake him, a temptation which is strong in a novice who begins to feel that he is getting to master his machine. It will also be well for him to practice the use of the brakes and the entire shutting off of power for the purpose of learning to make quick stops, even if this is done at the cost of some wear to the tires. Once thoroughly familiar with this process, it

should only be used when absolutely necessary, as too sudden stopping is a tremendous strain on the tires, and often causes skidding, even on dry roads.

Special care should be taken when driving on wet asphalt pavements or other slippery roads, and more so if the tires are worn and unprovided with an anti-slipping device. Under such conditions, sometimes a slight movement of the steering wheel or an obstacle in the road is sufficient to cause skidding, and in this case, the novice will always feel tempted to apply the brakes. This is a mistake which, however, is not apt to be serious if the car is going at slow speed. On the other hand, the applying of the brake to skidding wheels is a dangerous affair when occurring at high speed. It is by far better to shut off the power entirely, as the car, while running on the momentum only, is easier of control, and the power, unless the car has stopped or is moving too slowly, can be picked up again on a slow speed when it is seen that the vehicle once more obeys the steering wheel.

The noise of the engine is a point which should be studied, in order to be able to distinguish by sound whether

there are any defects or whether, in cases of hill-climbing, the engine has arrived at its limit of power, in which case a change to lower speed is necessary to prevent the stopping of the car.

With advancing proficiency in driving, it is well to pay attention to the economical running of the car in the way of using less fuel by the proper handling of throttle and spark lever, and allowing the vehicle, in suitable places, to run on its momentum with spark and mixture supply entirely shut off. Having mastered the intricacies of driving, and with growing practice, the driver soon will learn to observe and distinguish, without taking his attention from the road, all the various noises of his machine which either indicate that everything is alright, or that there are defects in certain parts of the car mechanism which need looking after. Having arrived at this point, he will fully enjoy the pleasure of motoring in a self-driven car.

As to the proper conduct of the driver on the public roads, a careful perusal of the chapter on Automobile Etiquette is earnestly recommended.

CHAPTER XX

THE MANUFACTURE OF AN AUTOMOBILE.*

The process of building a motor car is so little known to the layman and average motorist that a short description of it will, doubtless, prove of interest.

The first phase of the actual construction of an automobile must be observed in the Raw Stock Rooms of the factory which contains all the bewildering variety of material that goes into it. It is only when walking about these rooms that one realizes that it takes over 1500 distinct parts to complete a modern motor car.

To follow up the further phases of construction, the raw stock must be traced on its way to the various departments where it undergoes considerable change, and where it can be met with again in polished and refined form, devoid of all crudeness and fit to take its place in the best of automobile society.

Before proceeding, however, it is advisable to separate the raw stock into two distinct groups to be traced successively: one which is destined to go into the chas-

* This is an excerpt from an article on the same subject written by the author, and published in "The World To-day"

sis and the other into the body. The chassis being the more important, is to receive first attention, and it is perhaps advisable to repeat for the benefit of the layman that a chassis is the wooden, steel-enforced or pressed steel frame on wheels in which are suspended the motor, running gears, steering apparatus and other mechanical parts, and to which, after its completion, the car body proper is attached. The latter consists of front seats and tonneau, dashboard, hood and mudguards.

All metal parts of the chassis that need refinement and perfection in the way of brazing, cutting, shaving, drilling, boring, polishing and general machining go first to the Machine Shop where the necessary touches are administered and the proper temper is given. Here scores of gear shapers, lathes, milling, grinding, screw and other machines and presses perform their work of producing crankshafts and pinions, starting cranks, valves, cones, sprockets, flywheels, carbureters, transmissions, levers, steering devices, cylinders, pistons, connecting rods and a hundred other parts. The work is done by hand, by machines served by men and by automatic machinery

dispensing with human help altogether. Thousand-pound-bars of steel are handled with the smallest parts, and some of the work has to be done with such an accuracy that it necessitates the use of micrometers to measure thicknesses of 1-2000 part of an inch. This is the case with crankshafts, cams and other parts that have to fit to perfection in order to make the intricate machinery do its work smoothly. All parts that go out from the Machine Shop are scrupulously examined by expert inspectors before they are delivered to the Finished Stock Room, whence, in turn, they are distributed to the various departments.

Attention must next be directed to the Motor Assembling Room. Since the motor is the most important part of an automobile, its assembling is a process which involves the utmost skill and care. The room in which it takes place is furnished with work benches, roller stands on which the assembling is done, and drill presses for valve grinding and pinning. The engine is placed on the stand where it receives successively the crank and camshafts, base bearings, connecting rods and cheek pieces. Afterward the cylinders, containing pistons and piston

rings, with water jackets (in the case of air-cooled cars without the latter) are bolted on to the base; valves, yokes, inlet and exhaust pipes are fitted and, where a planetary transmission is used, the fly-wheel is attached. All discrepancies of diameter and fitting have to be rectified, even if only by the touch of emery cloth, in order to secure minute exactness of shape and dimension.

After assembling, the motors are sent to the Testing Room for further development. There they are put on testing blocks and, after thorough lubrication of the parts, run for a period of hours at a speed of a thousand or more revolutions per minute for the purpose of breaking in and getting the cylinder compression. Following this test the motors are connected to power fans and chains or shafts where they run from six to ten hours for detection of defects. Everything appearing satisfactory and after a last thorough examination and another oiling, the engines are transferred to the Final Assembling Room to be put into the chassis.

Next to the motor in point of importance is the construction of the running gear, as it is this part of the automobile

on which depend not only the carrying capacity and general strength, but part of the riding quality. The running gear forms the connecting link between the wheels and the body proper, and the parts handled in this department are the differential or compensating gear, the front and rear axle, axle housings, springs, knuckle connecting rods, diagonal steering rods, spring bolsters, clips and some smaller parts.

These parts being put in their places, the running gear is mechanically ready to be attached to the frame of the car, but not being in proper dress it first has to undergo an external metamorphosis in the Paint Shop before it is transferred to the Final Assembling Room.

The next step in search for instruction leads to the Wood Shop where the first work on the bodies is done, and where rip saws, swing saws, disc sanders, spindle shapers and great triple drum sanders turn the raw material into shape. The Wood Shop turns out in the rough tonneaus, front seats, seat rails, sills, car floors, dash-boards, seat bottoms, running boards, battery and tool boxes, patterns, trimmings and special work of various nature. Among the woods prin-

cipally used are elm, whitewood, second-growth white ash, basswood and mahogany, the stock being thoroughly seasoned before use. A special metal-lined laminating room is often attached to the Wood Shop where a constant and even temperature of 90-100 degrees is maintained. The whole product of this department goes to the Paint Shop for the finishing touches.

Many factories use aluminum sheets in the production of their car bodies for the purpose of diminishing the weight of the machine, and have a regular Metal Body Department. There coal and gas forges prepare the angle iron, which forms the frame for the seats and tonneaus, for the bending process. The iron is cut into proper lengths before heating and has rivet holes punched in it. The bending is followed by the brazing process which unites those parts that have to form integral pieces. The aluminum sheets, having been cut into correct shapes, are bent and riveted to the angle iron frames, the wood bottoms put into the seats, and, after all parts have had the rivet heads ground even with the surface, seats and bodies are joined together by screws and are provided with top

ironings. This is the stage when the wooden railings which hold the upholstery, are attached in the Wood Shop, the aluminum is rubbed smooth preparatory to receiving the first coat of paint, and the brass trimmings are fitted. Before going to the Paint Shop, however, a critical examination on the inspectors' table has to prove the work faultless in every detail.

The work done in the Paint Shop appeals strongly to the purchaser and plays a large rôle in selling a car. The Paint Shop is generally divided into one large space and one or two smaller sections. In the larger, the ground work, puttying and first painting is done. It also contains the so-called rubbing-deck, where, with powdered pumice stone and water, crudenesses are removed and the parts prepared for polishing. In the smaller sections, the last coats of paint and color varnish and the varnish rubbing are administered. Finishing touches and the final coat of varnish are put on in a dust-proof room of high temperature. It may be stated here, that to give a car that resplendent lustre and finish which adds so much to its appearance, it takes from eight to

sixteen coats of paint and varnish, the number depending on the various parts of the body and running gear.

While sills, gears and other parts are removed from the Paint Shop to the Final Assembling Room, the seats and tonneaus are transferred to the Upholstery Department, which provides the seating comfort of the automobile, before they are delivered to the same place.

In the Final Assembling Room the work is mostly done by hand. The process of assembling starts with the placing of the sills or steel frames on padded horses where the running gears, brake rods, steps or running boards and the engine trusses are attached. The frames are then taken from the horses and put on test wheels which are utilized until after the succeeding road test, when they are exchanged for the permanent wheels that go with the finished car. After this, engine and transmission, radiator, gasoline tank, steering device, battery and tool boxes, apron, oiler and spark coil go in, the wiring and brass trimming is done and lamp brackets are fitted. This completes the chassis, and with the attaching of tonneau and seats, the hinging on of the hood and riveting of the mudguards,

the automobile is ready for examination and road test.

The test road is generally laid out so as to meet with all conditions of public highways and is sure to bring out any existing defects. If such develop, the testing expert returns the car for rectifying, and only after an entirely satisfactory trial is the car allowed to go to the Store Room or Shipping Department, whence it goes out into the world.

CHAPTER XXI

AUTOMOBILE ETIQUETTE

GENERAL HINTS TO OWNER AND DRIVER.

There is unquestionably a strong prejudice against motorists in general, which, while sure to be overcome in due time, is to-day a factor never to be lost sight of by owner and driver. In order sooner to eliminate this prejudice, the following points should always be kept in view:

1. Become well acquainted with the laws and regulations of your state and municipality relating to automobile traffic, and obey them rigidly.

2. Don't take intoxicants when you expect to go behind the steering wheel, or even when being driven by your chauffeur. Chance may force you to the driver's seat, and liquor is the worst enemy of an automobile driver. In engaging a professional chauffeur give preference to a total abstainer; otherwise see that he is in perfectly sober condition when you want his services.

3. See that your car does not emit too offensive an odor or too much smoke.

With a little care this can be prevented, just as well as the excessive dripping of oil which especially damages the asphalt pavements.

4. Don't make too liberal use of the horn. It is annoying and often confusing. Use it when necessary.

5. In driving in the city, always consider that you don't own the road, and that other vehicles, cyclists and pedestrians have the same rights as you. Never allow your attention to be diverted from the road ahead of you, and keep a sharp lookout at crossings, near crowds and especially in streets where children are playing in the road or on the sidewalks. The latter are apt to run out into the street in the excitement of play. Don't get out of patience if, in a spirit of mischief, they throw things at the car, or, apparently, try to cross in front of it. It is aggravating, but it is better to stop than to take chances. If something happens the public will be against you, no matter how innocent you are in the matter.

6. In driving over country roads, use judgment as to speed. Never drive fast unless you can overlook the road for a considerable distance ahead of you, and unless it is absolutely free of obstructions

in the shape of man or beast. By no means exceed the speed allowed for the location. In meeting a horse-drawn vehicle remember that country horses are not usually broken to automobiles. Slow down in passing, especially if their driver gives a sign to that effect. If the animals appear much frightened, stop your engine until the vehicle has passed you. Be considerate as to animals on the road, and if you happen to inadvertently kill or maim one try to find its owner. Don't run away. Car numbers are easily read, and it is much cheaper and more convenient to settle amicably on the spot than to be cited to court. Remember this maxim too in case of collisions where the damage extends only to material.

7. In case of accident to human beings, resulting in injuries or fatalities, whether caused by your own carelessness or not, show kindness and utmost consideration. Act as a man should act. Don't shirk responsibility. Give your name and address willingly to the interested parties, but be careful to establish the responsibility for the accident, there and then, by witnesses if you are not at fault. In any case, show humanity, and drive the injured to where he can get

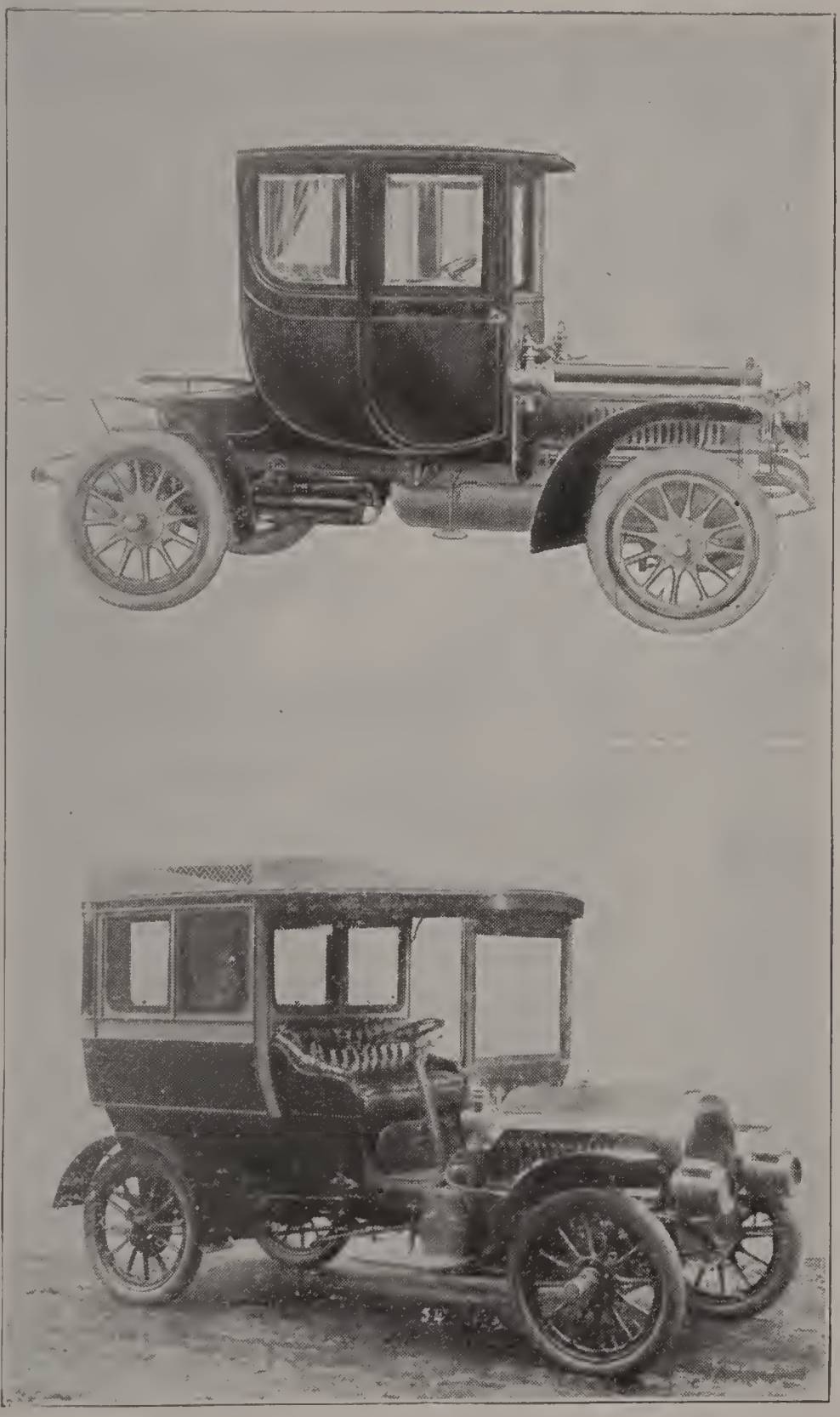
quickest medical aid. Consideration and kindness will always act as a mitigating circumstance when it comes to a jury trial. Brutality is a boomerang.

8. Stop at the first sign given by a police official, and don't get into a heated argument with him, even if you have the right on your side. A little politeness often saves trouble and fines.

9. Carry insurance against damage to your car, as well as against financial loss resulting from damage suits of any nature arising from motor accidents. There are companies making a speciality of such insurance. Under no conditions, however, allow the fact that you are insured to operate against due care in driving your car and the general observation of the hints given above.

TYPES OF AMERICAN AND FOREIGN MOTOR CARS

LIMOUSINE (Pierce Great Arrow).
KING OF BELGIUM TYPE (Thomas).



Coupé (Cadillac).
Opera Coach (Pierce Great Arrow).

TOURING CAR (Locomobile).

RACING CAR (Locomobile).

Collapsible Landaulet (Packard).
Royal Victoria (Columbia).

Buggy Type Runabout (Holsman).
Four-Cylinder Runabout (Ford).

BABCOCK ELECTRIC RUNABOUT.
DOCTOR'S RUNABOUT (Premier Air-cooled).

FOREIGN TYPES OF AUTOMOBILES

MERCEDES (German)

RENAULT (French)

NAPIER (British).

PANHARD (French).

AUTOMOBILE LAWS OF THE U. S.

ABBREVIATIONS.

ABBR., abbreviation; BETW., between; CERTIF., certificate; DISTR., district; H., hour; IMPRIS., imprisonment; INC., incorporated; INCL., including; INIT., initials; INTERSECT., intersections; LIC., license; MUNIC., municipality; M., miles; NUMB., number; POP., populated; PROVIS., provision; REGIST., registered; REGISTR., registration; REQU., required or requirement; RES., or RESID., residence or resident; SUFFIC., sufficient; TRANSF., transferable; TEMP., temporary; VIOLAT., violation; W., with.

ALABAMA. Regist. w. Prob. Judge; Fee 25 cts. w. non-transf. certif; No numb. requ.; Non-res. same privileges; Speed per hour: 8 miles and 4 miles at dams and causeways of not over 20 feet width; Penalties: 1. offense $20-100, subsequently $50-200 or 30 days to 6 months impris.

ARIZONA. No laws.

ARKANSAS. No laws.

CALIFORNIA. Regist. Sec'y of State; Fee $2.00 w. cert. not transf.; Numbers 3 inch high rear of car w. abbr. name of state not less than 1 inch high; 2 white lamps front w. car numb., 1 red rear light; Reg. numb. of own state for temp. stay of non-res.; Speed always reasonable —10 m. per h. in pop. distr., 15 m. in inc. munic., 20 m. elsewhere, 4 m. near and on dams, bridges, curves and sharp incl.; Penalties for 1. offense not over $100, 2d $50-100 or 30 days, subsequently $100 -250 and 30 days.

COLORADO. No laws.

CONNECTICUT. Regist. Sec'y of State; Fee $1.00; Numbers 4 inches high w. init. of state front and rear of car; 15 days per year free for non-res., but own state numb. and init. requ.; Speed always reasonable—12 m. per h. in cities, 15 m. in country; Penalties: 1. offense up to $200 or 30 days or both; 2d. offense up to $500 or 60 days or both; subsequently same. Other but speed violat. not over $50.

DELAWARE. Regist. Sec'y of State; Fee $2.00; Number 3 inches high rear of car; 2 white lamps front, 1 red light w. number; Non-res. exempt for 48 h.; Speed always reasonable, 10 m. at sharp

curves and intersect. in open country, 8 4-7 m. in cities, towns, etc., 20 m. elsewhere; Penalties: $100 or 30 days for illegal display of number; $50 or 20 days for racing and betting; not more than $100 or 30 days for other offenses.

DIST. OF COLUMBIA. Qualification before board of examiners; No fee; 3 inch number rear of car w. init. D. C. not less than 1 inch high, non-transf.; 2 front lamps, 1 rear showing red and white from 1 h. after sunset to 1 h. before sunrise; Own state credentials suffic. for 60 days for non-res.; Speed 4 m. rounding corners in Washington, 6 m. at crossings w. tracks, 12 m. in streets w. no tracks, 15 m. in country; Penalties, $1.00-$40 for each offense.

FLORIDA. Registr. w. Sec'y of State; Fee $2.00; Number 3 inch long and 2 inch wide rear of car; Driver must carry certif. of registr. or permit; Two lamps betw. sunset and sunrise; Non-res. w. lic. from own state exempt for 30 days; Speed 4 m. at sharp curves, bridges, fills and intersect., otherwise reasonable; Penalties: Speed violat. 1. offense up to $100, 2d. not less than $50 or more than $100 or impris. to 30 days or both, 3d. offense not less than $100 nor more than

$250 or impris. up to 60 days. Other violations up to $100 or impris. to 10 days or both.

IDAHO. No laws.

ILLINOIS. No state registr., consult local authorities as to fees, numbers, lamps, non-res. requirements; Speed 15 m. except where local laws provide otherwise; Penalties: $25-200 or impris. up to 3 months or both.

INDIANA. Regist. w. Sec'y of State; Fee $1.00; Number 4 inch and abbrev. state name 2 inch high rear of car; Own state number suffic. for non-res.; Speed always reasonable, 8 m. in closely built parts of municipalities, 15 m. in other parts, 20 m. elsewhere; Penalties not to exceed $50.

IOWA. Regist. w. Sec'y of State; Fee $1.00; Number 3 inch and abbrev. state name 2 inch high rear of car; 1 lamp forward showing white and 1 rear lamp showing red light; Own state number suffic. for non-res.; Speed always reasonable, 10 m. in closely, 15 m. in thinly built sections, 20 m. in country; Penalties: 1. offense up to $25, 2d, $25-50 or 30 days.

KANSAS. No state registr., consult local authorities as to fees, numbers and

non-res. provisions; Lamps w. white light from one h. after sunset to one h. before sunrise; Speed always reasonable, 10 m. in pop. districts, 20 m. elsewhere; Penalties not to exceed $100.

KENTUCKY. No state registr., consult local authorities as to fees, numbers, and non-res. provisions; White lamp in front, red in rear when necessary between sunset and sunrise; Speed always reasonable, 6 m. at crossings, bridges, curves and inclines, 15 m. elsewhere; Penalties $10-100.

LOUISIANA. No special laws. Consult local authorities.

MAINE. Registr. w. Sec'y of State; Fee $2.00; Number 4 inch and state name 1 inch high at front and rear of car; Lamp 1 h. after sunset to 1 h. before sunrise; Non-res. exempt on display of own state name and number in front and rear of car; Speed always reasonable, 8 m. in cities and towns, except where more is allowed, 15 m. elsewhere; Penalties up to $50 or impris. to 10 days.

MARYLAND. Regist. w. Secy. of State; Fee $1.00; Number 3 inch in conspicuous place; 2 white lamps front and 1 red light in rear; Non-res. must register; Speed 6 m. at sharp curves,

intersections of cross roads in country or on highways through built-up parts of cities, elsewhere 10 m.; Penalties $25-50 for speed, $20 for lamp ordinance and $50 or 30 days for number provision violations.

MASSACHUSETTS. Registr. and license through Mass. Highway Comm.; Fees $2.00 registr. and $2.00 license, 50 cts. renewal, private operator's license indefinite, chauffeur's good for 1 year, certif. to be carried in car; Numbers 4 inch high in front and rear; One white lamp on each side in front with register number; Non-resid. exempt for 15 days, afterwards subject to law; Speed 10 m. in cities, 15 m. in country, 8 m. at curves and intersect., always reasonable; Penalties: 1. offense up to $25, 2d. up to $50, subsequent offenses within year not more than $100; for running car after revocal of license $100 or 10 days.

MICHIGAN. Seal and certif. from Sec'y of State; Fee $2.00; Conspicuous number 3 inch high and abbrev. or full name of state 1 inch high; 2 white lamps front and 1 red light rear; Own state number sufficient for non-resid. if laws are similar; Speed always reasonable, 8 m. in business part of cities, 15 m. in other

parts, 25 m. elsewhere; Penalties: 1. offense up to $25 and costs or impris. to 10 days, 2d. up to $50 and costs or impris. to 30 days, subsequently up to $100 and costs or 30 days or both.

MINNESOTA. License by state boiler inspector; Fee $2.00; Number 4½ inch high in rear; One lamp at least; No special requ. for non-resid.; Speed 4 m. at crossings, 8 m. in built-up parts, 25 m. elsewhere; No special penalties provided, but general laws provide fines up to $100 or impris. to 3 months.

MISSOURI. License from county clerk or license commissioner; Fee $2.00 per year; Number in conspicuous place; 2 lamps w. 3 inch numbers in front; No special requ. for non-resid.; Speed 9 m.; Penalties $100-1,000 or 30 days to 6 months, or both.

MONTANA. No state provis. for registr.; Consult local authorities about fees, numbers, lamps and non-resid. provisions; Speed 8 m. within city and fire distr. limits, thickly settled or business parts of towns,20 m. elsewhere; Penalties not more than $100 or 60 days, or both.

NEBRASKA. Seal from Sec'y of State; Fee $1.00; Number 3 inch and abbrev.

name of state 2 inch high rear of car; At least 1 white front lamp and 1 red rear light between sunset and sunrise; Own state number and initial sufficient for non-resid.; Speed always reasonable, 10 m. in built-up parts of cities, towns and villages, 15 m. in other portions, 20 m. elsewhere; Penalties for 1. offense up to $25, subsequently $25-50 or 30 days.

NEW HAMPSHIRE. Regist. w. Sec'y of State; Fees $1.00 for annual operator's license and $3.00 for registr., certificate always to be carried; 2 numbers 4 inch high front and rear w. abbrev. state name; 2 lamps w. 1 inch numbers; Non-resid. exempt, but subject to suspension by Sec'y of State; Speed 8 m. in business and compactly built parts of cities and towns, 20 m. elsewhere; Penalties: 1. offense up to $10 and costs, subsequently up to $50 and revocation of license; for operating after revocal up to $100 or 30 days, or both.

NEW JERSEY. License from Sec'y of State; Fee $1.00 per car used; dealer's license $10.00; 4 inch number in front and rear; 2 front lamps w. 1 inch numbers and 1 red rear light between sunset and sunrise; Non-resid. must have license; Speed always reasonable, 20 m.;

Penalties: not more than $100 or 30 days for false number, $50 for no license, $15-50 for failure to display number, $50 for speeding; in default of payment impris. to 10 days; subsequent offense double penalty or up to 10 days in default of payment.

NEW YORK. Seal by Sec'y of State; Fees $2.00 for chauffeurs, owners and manufacturers; renewals for chauffeurs and owners $1.00, for manufacturers 50 cts. Certificate to be returned with sale of car; 3 inch number w. 1 inch init. letters of state rear of car; 2 front lamps w. 1 inch numbers and one red rear light; Own state number sufficient for non-resid.; Speed always reasonable, 10 m. in built-up sections, 15 m. where distance betw. houses is less than 100 feet, 20 m. in country, 4 m. at bridges, curves and steep inclines; Penalties: Violations of speed and local laws, false number, non-display of number and chauffeur's registr. up to $100 for 1. offense, 2d. offense $50-100 or impris. to 30 days, or both; subsequently $100-250 and impris. up to 30 days; violations of other provisions from $25-100 or impris. up to 10 days, or both.

NORTH CAROLINA. No special laws. Board of Commissioners regulate speed

and use of all vehicles. Violations of any of these provisions $50.00 maximum or not to exceed 30 days imprisonment.

N. DAKOTA. No state provis.; consult local authorities as to registr., fees, numbers and non-resid. provis.; One lamp requir. during hours of darkness; Speed 8 m. in cities, towns and villages, 15 m. in country, 4 m. at crossings when occupied by persons; Penalties $5.00-50 or 5-30 days, or both.

OHIO. No state provision; consult local authorities about registr., fees, numbers and non-resident provis.; At least 1 white front lamp and 1 red light in rear from sunset to sunrise; Speed always reasonable, 8 m. in business and built-up parts of municipalities, 15 m. in other portions, 20 m. elsewhere. Penalties $5.00-50.

OREGON. Registr. w. Sec'y of State; Fee $3.00; 3 inch number, preceded by "Ore" rear of car; At least 1 white front lamp with number and red rear light; Non-residents have same privil. as residents; Speed 8 m. in business and built-up parts of cities and other municipalities, also in country when within 100 yards of horse-drawn vehicles, 4 m. at occupied crossings, 24 m. in country.

Penalties: up to $25 for 1. offense, up to $50 for 2d. and up to $100 for subsequent offenses.

PENNSYLVANIA. License from State Highway Dept.; Fee $3.00 per year; 5 inch number in front and rear of car; 1 white front lamp and red rear light, rear number to be illuminated; Non-residents same privileges as residents; Speed 10 m. in cities and townships, 20 miles elsewhere; Penalties: first offense $10-25 or 10 days in case of non-payment, subsequently $25-100 or 30 days and revocal of license for 6 months.

RHODE ISLAND. Certif. from Sec'y of State, certif. must be carried in car; Fees $2.00 for owners, $10 for dealers; 3 inch number in rear; Number of lamps as approved by Sec'y of State; Own state number sufficient for non-resid.; Speed within safety limit, motor to be stopped when necessary; Penalties up to $20 or 3 months imprisonment for any violation.

SOUTH CAROLINA. No state provis.; consult local authorities as to fees, numbers and non-resid. provis.; White lamp with red rear light at night or in fog; Speed always reasonable, 6 m. at bridges, descents, curves or intersections, other-

wise 15 m. Penalties $10-100 or impris. up to 30 days.

SOUTH DAKOTA. Seal from Sec'y of State; Fee $1.00; 3 inch number and 2 inch letters "S. D." in rear; 1 white front and 1 red rear light w. 1 inch numbers; Own state number sufficient for non-resid.; Speed always resonable, 10 m. in closely built-up parts of cities and towns, other parts 15 m., 20 miles elsewhere; Penalties; 1. offense up to $25, subsequently $25-50 or impris. for 30 days.

TENNESSEE. Certif. from Sec'y of State; Fees $2.00 for certificate and $1.00 to county clerk for filing; 3 inch numbers in front and rear.

No lamp provision; Non-residents same rights as residents; Speed 20 m. with right of municipalities to lower; Penalties $25-100.

TEXAS. No laws other than those relating to taxation.

UTAH. No laws.

VERMONT. Certif. from Sec'y of State; Fee $2.00 per year; 4 inch number conspicuously displayed; Lamps w. numbers as prescr. by Sec'y of State; Non-resid. subject to speed and other regulations of Sec'y of State; Speed 10 m. in city. village, thickly settled and fire dis-

tricts, 6 m. at intersect. and curves, elsewhere 15 m.; Penalties: first offense up to $50, subsequently not more than $100 or 10 days; $50-200 or 10 days, or both, for operating car after license has been revoked.

VIRGINIA. No state provisions; local authorities should be consulted as to registr., fees, numbers, lamps, non-resid. provis.; Speed 15 m. and 4 m. in passing a preceding car which has stopped; Penalties $10-100.

WASHINGTON. Certif. from Sec'y of State; Fee $2.00 per year; 4 inch number with letters "Wn" in rear; At least 1 white front and 1 red rear light w. number on front light; Own state number sufficient for non-resid.; Speed always reasonable, 12 m. in business or thickly settled parts of city or village, 4 m. at crossings and 24 m. in country; Penalties up to $100.

W. VIRGINIA. Tags from State Auditor; Fee $1.00 per year; Numbers in front and rear of car; No provis. for lamps, speed and non-resid.; Penalties: $5.00-25 for destroying tag of others, $20-100 for driving without tag, $25-100 or impris. up to 3 months for operating without license.

WISCONSIN. Dupl. certif. (one to be carried in car) issued by Sec'y of State; Fees $1.00 for owner and $5.00 for general registr.; 3 inch number with letters "W" in rear of car; At least one front lamp; Own state number suffic. for non-resid.; Speed 12 m. within corp. limits of cities or villages, 25 m. in country; Penalties $10-50.

WYOMING. No laws.

RACING RULES OF THE AMERICAN AUTOMOBILE ASSOCIATION.

SANCTIONS.

1. *Sanctions.* A person, association or club (hereinafter designated the Promoter) desiring to hold a race or series of races under the rules of the American Automobile Association, shall first obtain a sanction from the Chairman of the Racing Board. No announcement of such race or races shall be made until such sanction shall have been obtained.

2. *Applications.* Application for such sanction shall be made to the Chairman of the Racing Board and shall be accompanied by a fee of fifty dollars for non-members of the American Automobile Association, or ten dollars for members, and shall set forth the name and address of the Promoter; a schedule of the events and distances; the number and value of the prizes; the amount of the entry fees and details of the course. If the event is to be run on a public highway the Board may require evidence of the permission of the proper legal authorities.

3. *Refusal.* The Racing Board reserves the right to refuse a sanction without assigning a reason therefor.

4. *Evidence of Precaution.* Promoters, before sanctions will be granted, must, if requested by the Racing Board, demonstrate to the Board that every reasonable precaution to save harmless (in so far as possible) the general public and contestants has been taken. This includes laying dust, patrolling the course, closing highways, etc.

5. *No Changes.* After a sanction has been granted no change may be made in any of the details required to be set forth in the application for same, except with the approval of the Racing Board. No change in the itinerary of a road race may be made without the approval of the Racing Board. In the event of such approved change, the promoter must give the widest possible publicity to the change and shall be charged with the duty of advising all those interested, of such change.

6. *Transgression.* No sanction shall be granted to a promoter who shall have previously transgressed the racing rules of the American Automobile Association, or permitted their transgression at a

meeting under his management, until he shall have been restored to good standing by formal action of the Racing Board.

DUTIES OF PROMOTERS.

7. *Entry Blank.* On receipt of a sanction the promoter shall prepare an entry blank, which shall show the details set forth in Rule 2; the date of the closing of entries; the address to which entries must be sent; and which shall require the entrant to supply the name of the operator; the machine he will drive; the name of the maker; the motive power; the weight; the number of cylinders; the rated horse-power; and the date of mailing the entry. It shall bear upon its face the words, "Under the rules, and with the sanction of the Racing Board of the American Automobile Association."

8. *Send Copies.* A copy of the entry blank shall, immediately upon its issue, be forwarded to the Chairman of the Racing Board. A copy of these rules shall be sent by the Promoter to every entrant.

9. *Send Rules.* Each driver shall be provided with a copy of these rules before competing in any event which may be promoted thereunder.

10. *Send Records.* The promoter shall forward to Secretary of the Racing Board within forty-eight hours after the meet, a complete record of the meet, showing the winners of each event and the times made, which record shall be signed by the referee and timers.

11. *Programme Contain.* The programme shall bear upon its face the words: "Under the rules and with the sanction of the Racing Board of the American Automobile Association," and shall set forth the distance of each race; description of prizes and their value; a copy of the rule relative to the classification of automobiles for racing; the manner of starting; a list of the names of the officials strictly in accordance with the rules relating to same; and a list of the entrants and their numbers.

ENTRIES.

12. *Entries.* The acceptance of the entries shall be limited to persons who have not, since the first day of January, 1903, taken part in any automobile race or hill climbing test not sanctioned by the Racing Board of the American Automobile Association; and who have never knowingly competed with a person not

eligible under the rules and rulings of the Racing Board; who agree, by their signatures to the prescribed entry blank, to recognize the jurisdiction and decisions of the Racing Board of the American Automobile Association in racing matter; and who have not been debarred from competition in events over which the American Automobile Association or the governing bodies of other nations have jurisdiction.

The act of competing in an unsanctioned meeting, or in an unsanctioned event, shall disqualify without action of the Racing Board, and such disqualification shall remain in effect until removed by formal action of the Racing Board.

13. *Car and Operator.* An entry shall consist of a combination of operator and car, the latter being described at the time of the entry. No change of car shall be permitted after an entry has been filed, nor of operator without the consent of the Referee.

14. *Receipt and Acceptance of Entries.* No entry shall be accepted after midnight of the day set for the closing of entries, no entry shall be accepted unless accompanied by the entry fee and

all the details required to be set forth in the entry blank. Acceptance of an entry under other conditions shall be a sufficient reason for the refusal of a subsequent sanction to the offending Promoter.

15. *False Entry.* Should a false declaration be made intentionally by an entrant, the Racing Board may, in its discretion, disqualify the entry and penalize the entrant.

16. *More than One Car.* Entrants, when declaring more than one car for an event, shall specify in detail each car declared at the time of entry.

17. *Assumed Name.* Any person who desires to race under an assumed name must first register such name with the Racing Board, and shall continue to race under the name so registered until withdrawn by permission of the Racing Board.

18. *Amateur.* An amateur driver is one who does not race for hire, or who is not actively engaged in the automobile trade, or who does not make his livelihood or any part of it as a result of his racing, or who has never been declared a professional by any sport governing body.

CLASSIFICATION.

19. *Automobile, Motor Car, Car.* An automobile, motor car or car within the meaning of these rules, is a four-wheeled track or road vehicle propelled by self-contained mechanical means, and provided with suitable brakes, a differential gear or its equivalent, and a reverse gear.

20. *Standard Classification.* The standard classification of motor cars shall be by weight as follows:

(A) Cars from 1432 to 2204 pounds.
(B) Cars from 851 to 1432 pounds.
(C) Cars from 551 to 851 pounds.
(D) Cars from 110 to 551 pounds.

21. *Other Classifications.* In races where classifications other than those provided in Rule No. 20, are scheduled, such details and the details of classification must be submitted to the Racing Board for approval before the announcement of the event.

22. *Two Persons to be Carried.* In Classes "A" and "B" cars must carry at least two persons seated side by side, whose per capita weight shall be not less than 132 pounds. (60 kilos.)

By way of exception, in races on tracks and for record making, vehicles seated for two persons will be allowed to be occupied by one person only, but the necessity for two persons is indispensable in races on roads.

23. *Weigh in Empty.* The weight of the cars in the several classes shall be computed in an empty state, i. e., without operators, supplies, (fuels, lubricants, water or batteries), tools, spare parts, luggage, clothing, provisions, lamps, lamp brackets and horns.

24. *Magnetos.* Cars supplied with magnetic generators, actuated by the motor, shall be allowed a maximum of 15 pounds (7 kilos).

25. *Motor Exhausts.* Motor exhausts shall not be directed toward the ground by reason of the dust created and the consequent danger to the following competitors. The direction of the exhaust will be checked and regulated before starting.

26. *Distinguishing Marks.* Cars shall not be allowed to carry any distinguishing mark other than the official designations provided by the promoters, which shall consist of a numeral placed on each the right and left side of each

car, and where possible, on the front of the bonnet or hood.

OFFICIALS.

27. *Referee.* The principal officer of a race meet shall be a Referee, whose duty it shall be to exercise general supervision over the affairs of the meeting and to act as the representative of the Racing Board. He shall, if necessary, assign the judges, timers, umpires, clerk of the course, and starter to their respective positions and instruct them as to the rules. He shall receive all protests and render decisions thereon, subject to appeal to the Racing Boad as provided for hereafter in these rules. It shall be his duty to enforce and make a full report to the Chairman of the Racing Board of transgressions thereof either by promoters, contestants or officials.

28. *Judges.* There shall be three Judges whose position shall be on, or at the edge of the course, two at one end and one at the opposite end of the tape. The numbers of the placed cars shall be taken, one each by the three Judges respectively. The decision of the Judges as to the order of finishing shall be final. The judging of the cars shall be deter-

mined by the instant of contact of the tires of the front wheels with the tape.

29. *Timers.* There shall be three Timekeepers whose sole duty it shall be to accurately calculate, report and record the elapsed time of placed contestants. The Board may require evidence of the competency of timers.

30. *Starter.* It shall be the duty of the Starter, after he has been advised by the Clerk of the Course that the contestants are ready, to ascertain that the Timers are ready and then give the signal to start by firing a pistol. He shall have absolute control of the competitors from the time they are reported by the Clerk of the Courses until the start has taken place. In the event of a moving start, the Starter alone shall have power to decide what is a fair start and may use a flag instead of a pistol as a signal.

31. *Clerk of the Course.* There shall be a Clerk of the Course, with as many assistants as may be necessary. It shall be his duty to notify competitors, in due time, of the events in which they are entered; see to the arrival of the competitors at the starting point on time and to place them in their respective positions.

32. *Umpires.* There shall be two or more Umpires, whose duty it shall be to take positions assigned them by the Referee, to note carefully the progress of the race and be prepared to report upon claims of unfair driving by contestants.

33. *Scorer.* There shall be an official scorer, whose duty it shall be to keep a proper record of the time of each event, which shall be signed by each of the timekeepers.

STARTING.

34. *Failure to Start.* Any entrant to a race who fails to appear or who fails to start in the race, unless excused therefrom by the Referee for a good and sufficient reason, shall be reported to the Racing Board by the Referee, and by the Board subjected to discipline by suspension, disqualification or other penalty in such degree as in its judgment seems best to the Board.

35. *Method of Starting.* Starts may be standing, moving or flying. Due notice of the method must be given on the programme, but in the event of failure to state the method a standing start shall prevail.

36. *Standing Start.* In a standing start the car must be stationary with its front wheels on the tape until given the word or signal to go. Time will be taken from the word or drop of the flag or the firing of a pistol.

37. *Moving Start.* In a moving start cars must start at a point between two hundred and three hundred yards back of the tape. The pace from this point to the tape must be taken from the pole or inside car.

38. *Flying Start.* In a flying start a car may start at any distance back of the tape and cross the tape at the highest possible speed. This method of starting may be employed only where a single car is running for a record or in a time trial.

39. *Position.* In all races the position of the contestants at the start shall be decided by lot.

40. *Delay.* A contestant who fails to respond promptly to the call of the Clerk of the Course shall forfeit his right to his position and shall take the outside. There shall be no delay at the start on account of absentees and no contestant shall be permitted to take a place in the line after the contestants have been reported to the Starter by the Clerk of the Course.

41. *Starting Cars.* Starting of cars must be effected only by means of the motor, and without other means, as pushing by hand, lever, etc. This rule applies not only to the start at the beginning of the event, but to resting after any stoppage for any cause whatever, except as provided in Rule 54.

42. *Referee's Decision.* In the event of a protest relative to classification of a car or other matter which shall affect the right of a car to start, the Referee may, unless able to render an immediate decision, allow the car to start and render his decision as soon after the event as may be possible.

43. *Demonstrate Ability.* The referee and the judges may, in their discretion, require the operator of any car to demonstrate his ability to properly handle the car in which he proposes to compete.

44. *Prohibit.* The referee shall have absolute power to prohibit any car which he considers unsafe, unsuitable, or of improper construction to start in any event.

HEATS.

45. *Heats.* The Referee shall, in case there are a larger number of en-

trants than can safely be started in one race, divide the contestants by lot into two or more heats, each as nearly equal in number as possible, and a final. In case a competitor is not able to start in the heat for which he was drawn, the Referee may transfer him to another heat at his discretion. The positions of the contestants in heats shall be according to the number drawn, the lowest number taking the inside with at least four feet intervening between the hubs.

46. *Final Heat.* The winners of each heat and any second car that makes faster time than any heat winner, shall compete in the final trial.

47. *Dead Heat.* In case of a dead heat the event shall be run again, unless the contestants agree, between themselves, as to the disposition of the prizes.

In the event of a dead heat being run off, the same car and the same operator shall be obliged to compete in the final heat.

48. *Walkover.* In the event of a "walkover" it shall be optional with the Referee whether the contestant be required to go the whole or a part of the distance. The Referee may impose a reasonable time limit.

TIMING.

49. *Timing Start and Finish.* The time of the start and finish shall be determined by the instant of contact of the tires of the front wheels with a tape, laid across the course.

50. *Handicap.* In a time handicap the time shall be taken from the start of the scratch contestant.

51. *Disagreement of Watches.* In the event of disagreement of the watches, two agreeing, their time shall be official. Should all the watches disagree, the middle time shall be official.

RULES OF THE COURSE.

52. *Course and Stand.* No person other than the officials, contestants and one assistant for each contestant shall be allowed upon the course. Contestants and attendants must leave the course as soon as the event in which they are engaged has ended.

53. *Leaving Course.* A competitor who leaves the course for any cause, must, if he desires to continue the race, start from the point at which he withdrew. A competitor who leaves the track or road, or is unable to continue, in a race

run in heats, shall not be allowed to compete in a subsequent heat of the same race.

54. *Cars not to be Pushed.* Cars must not be pushed, except by their own crews. This rule may be departed from under only the two following conditions:

(a) On leaving the enclosure, when approaching the starting line, and

(b) When necessary to get out of a bad place, not properly a part of the course, such as fording a stream, ditches, etc.

55. *Foul Driving.* Intentional foul driving shall be punished by disqualification for all subsequent events at the meeting, as well as the event in which the foul practice occurs, and may be further penalized by the Racing Board by suspension not exceeding six months for the first offense and permanent suspension for a second offense.

56. SPECIAL TRACK RULES.

(a) *Passing.* It shall be the duty of the operator of the leading car to hold the inside as nearly as may be practicable. One contestant overtaking and passing another, must pass on the outside unless the car in front shall be so far from the

inside as to render it safe to pass on the inside. After having passed to the front a competitor shall not take the inside, or cross in front of the competitor passed, unless a lead of a full length of his car has been established, under penalty of disqualification.

(b) *Rail.* All track races shall be run with the left hand of the operator toward the rail.

(c) *Passengers as Assistants.* A competitor may, if he elects, carry one assistant as a passenger. After having been passed by the Clerk of the Course no car shall receive attention at the hands of any person other than the competitor and his assistant.

57. SPECIAL ROAD RULES.

(a) *Rules of the Road.* Operators must comply with the regulations for road traffic, which include:

(1) Keep to the right when overtaken.

(2) Keep to the left when overtaking.

(3) Pass to the right when meeting a vehicle moving in the opposite direction.

(b) *Give Warning.* Cars shall give warning of approach as often as may be necessary, by means of a horn, or trumpet, or other instrument of like character. Bells or gongs may not be substituted.

(c) *Officials.* The usual officials provided for in track racing events, viz., referee, judges, timers, clerk of the course, starter, umpires and scorer, shall obtain in road races, with the exception that the number of timers may be increased with the demands of the event. All officials must be approved by the Racing Board before serving in their various capacities.

(d) *Umpires' Duties.* Umpires shall be placed at each turn in the course or circuit. It shall be their duty to report to the Referee on all matters which seem to demand the same. It shall be their further duty to know by observation as to whether or not an operator is hindering or otherwise willfully obstructing another car, or obstructing the course, contrary to these Rules.

(e) *Checkers' Duties.* Checkers. In addition to the officials already provided for there shall be appointed a requisite number of officials who shall be known as checkers. They shall be located at

points designated by the promoter. In addition to checking cars in their order of passing, it shall be their duty to enforce compliance with these Rules.

(f) *Time Check Box on Car.* To facilitate checking, every car competing shall be equipped with a box of uniform pattern, to receive the control vouchers provided. These boxes shall be supplied to each competitor by the promoter, he taking therefor a deposit of $5.00, which sum shall be returned to the competitor upon the return of the box to the promoter. These boxes shall be made securely fast to some part of the car, conveniently available to the timers and checkers.

(g) *Times at Controls.* In passing through controls the time of arrival shall be taken on the instant the front tire shall have stopped at a point of contact with the tape, and the time shall again be taken on the instant of starting from the tape at the exit of such controls.

(h) *Timers at Controls.* The timer at the entrance of the control shall make a note of the instant the tires come to a rest at the tape, making note of the same on the card, deliver this card to the person conducting the contestant through the

control, who shall, upon his arrival at the exit, deliver the same to the second timer, who shall thereon make note of the time of departure. This card must be deposited in the competitor's time check receptacle after the official record shall have been completed.

(i) *Timer's Card.* The timer or checker at the exit of control shall deposit the voucher in the box in advance of the time of start, noting thereon the instant of start.

(j) *Pilots through Controls.* Contestants shall be preceded through controls either by a person mounted on a bicycle, or shall be accompanied by a person competent to estimate the speed of the car, in order that as nearly as possible the full limit of time set for passing through the control shall have been consumed.

(k) *Follow Pilots.* Competitors must conform fully with the regulations established by the pilots mounted on bicycle, or be regulated by the instructions of the official who shall accompany him through controls. Competitors are warned that any deviation from this rule will result in penalizing them in the full time required for the control.

(l) *Failure to Pass Control.* Any competitor who shall fail to pass through a control, either by neglect, or willfully, shall be disqualified from further competition in the event.

(m) *Two Cars from Control.* If two vehicles shall come to the entrance of the control simultaneously, the checker or timer shall send them away together, from the limit of the control.

(n) *Repairs and Supplies in Controls.* While a car is passing through a control no repairs shall be made and no supplies shall be taken on.

(o) *Reports of Officials to Referee.* Immediately upon the close of the event, checkers and timers at all control stations, umpires and checkers along the route of the race, shall at once prepare reports of all that transpired, and immediately transmit the same to the Referee.

RECORDS.

58. *Records.* No time shall be accepted as an official record unless taken by at least three official Timers.

59. *Surveyor's Certificate.* Claims for records must be accompanied by a surveyor's certificate as to the correctness of the distance run measured, if on the

track, three feet from the pole, and if on the road, at its center, together with evidence that the course is level.

60. *Intermediate Distances.* In event of an attempt to lower the record for a given distance the acceptance of records at intermediate distances will not be allowed.

61. *Unofficial Times.* Times made in events where classification other than that provided in Rule No. 20 shall obtain, shall not be recognized as official, although awards may be made on their results.

PROTESTS, COMPLAINTS AND APPEALS.

62. *Protests and Complaints.* Protests or complaints of any kind must be made to the Referee within twenty-four hours after finish of the race involved. The protestant or complainant must accompany his complaint or protest with a fee of $10.00, which shall be forfeited to the promoter if the protest be not sustained. A protest, once lodged, may be withdrawn only by consent of the Racing Board.

63. *Contestants' and Owners' Protests.* Contestants shall be allowed to

complain in regard to foul driving, interference, or any other irregularity which shall have interfered with his rights under these Rules during progress of the event.

Complaints or protests on other matters, as to classification, eligibility to start, etc., may be made only by the owner or owners of competing car.

64. *Appeal to Racing Board.* An appeal from the decision of the Referee may be made to the Racing Board by the owner of the car against which the decision was made. Such an appeal must be forwarded to the Board within ten days after the rendering of the decision and must set forth fully the facts of the case, accompanied by sworn statements or affidavits necessary to substantiate the claim, and a copy thereof sent at the same time to the Referee from whose decision the appeal is taken. A fee of $50.00 must be sent with the appeal, which fee will be returned if the decision appealed from be reversed. No member of the Racing Board may sit on the Board when it is considering an appeal from a decision which he has rendered, or in which he is personally interested.

RESPONSIBILITY.

65. *Suits for Damages, Etc.* All suits of a civil or penal character, of any kind whatsoever, arising from competition in races held under these Rules, must be borne and resulting judgments satisfied by the competitor responsible for the action.

BETTING.

66. *No Betting Permitted.* The making or laying of bets or wagers shall not be permitted, recognized or tolerated.

DISQUALIFICATION.

67. *Disqualify.* Disqualification for any infraction of the foregoing rules shall debar the offender from participation in any and all of the awards for the event in which he competed.

POWERS OF RACING BOARD.

68. *Powers of Racing Board.* The Racing Board reserves the right to veto the appointment of any race official; to assign dates; to inquire into and deal in its judgment with all matters relating to racing, subject to the rules; to disqualify, either temporarily or permanently, persons guilty of infraction of these Rules; to determine who are and who are not

eligible to compete; to interpret these Rules and to decide any issue not covered herein as it may consider advisable.

69. *Amendments.* These Rules may be amended by the Board of Directors of the American Automobile Association.

THE GORDON BENNETT CUP RULES.

The Automobile Club of France is the guardian of a cup donated by Mr. Gordon Bennett, which is intended as an international challenge trophy. It shall be competed for under the following conditions:

I. Every foreign automobile club recognized by the Automobile Club of France is entitled to challenge for the cup and to dispute the possession of it with the Holding Club.

II. The clubs recognized are: The Automobile Club of Belgium; the Automobile Club of Austria; the Swiss Automobile Club; the Automobile Club of Turin; the Automobile Club of Great Britain and Ireland; the Automobile Club of Germany, and the Automobile Club of America.

Any club not mentioned in this list, desiring to be added thereto, must be accepted by a majority of the above-named clubs, providing this majority include the one or more clubs of the same country already recognized. Its name will then

be added to the list and it will enjoy all the privileges of the recognized clubs.

It is, nevertheless, well understood that on the motion of one club, duly carried, any club may be struck off this list.

III. Every qualified club wishing to challenge the Holding Club for the cup shall notify the latter of its intention before the first day of January in each year, by registered letter addressed to its president, and shall state the number of vehicles which will take part in the race. It shall also deposit with the Holding Club the sum of Three Thousand Francs. This sum shall be refunded if one of its representatives presents himself at the start. The President of the Automobile Club of France, even though his club does not take part in the race, shall always be informed by registered letter.

IV. Each club may be represented by one, two, or three vehicles, at its option, but the fact of its using but one or two shall not debar the other clubs from exercising the right to use three.

If two or more clubs of the same country should be admitted to the list of recognized clubs, it is well understood that that country can be represented by no more than three vehicles all told.

The clubs of the same country shall in such a case have to agree among themselves which of their vehicles shall take part in the race. In case of a disagreement, the vehicles shall be chosen in the order of entry.

V. The cup may be competed for every year between the fifteenth day of May and the fifteenth day of August. The exact date shall be determined by mutual agreement of the interested clubs before the first day of February in every year.

VI. In the case of the Holding Club receiving challenges from several clubs in due time, there shall be but one race wherein the challenging clubs and the Holding Club shall be represented by not more than three vehicles each.

VII. Vehicles qualified to compete must conform to the definition of the vehicle, as given in the Racing Rules of the Automobile Club of France, to wit:

The carriage shall weigh at least 400 Kilos and not more than 1,000 Kilos, and shall carry at least two passengers, side by side, of an average minimum weight of sixty Kilos each, it being understood that in case the average weight of the passenger should not amount to sixty

Kilos, the balance shall be made up by ballast.

The carriage shall be weighed empty. By empty is meant without passengers or supplies (coal, petroleum, water, accumulators) and without tools or extra pieces, or baggage, dress, or provisions.

Carriages which generate the necessary energy for lighting purposes from a mechanical device run by their motors shall be given an allowance of seven Kilos. The weight of the lanterns and horns is not comprised in the weight of the vehicles, but only that of the lantern holders.

VIII. The carriages in each and every one of their parts shall be entirely constructed in the country of the clubs which they represent.

IX. The carriages shall be operated by drivers appointed by the competing clubs. Their two seats shall be occupied during the entire duration of the race.

X. A commission shall act for the enforcement of these rules. Each competing club shall nominate a delegate. Mr. Gordon Bennett shall always be an ex-officio member of this commission. The Automobile Club of France, even though it does not take part in the race, shall also

ex-officio be represented by a delegate in the commission.

The delegates shall name outside of their own number a president, who, in case of a tie vote, shall cast the deciding ballot. If the delegates should not be able to agree upon the choice of a president, then he shall be appointed ex officio by Mr. Gordon Bennett, or in his default, by the President of the Automobile Club of France. The commission shall appoint a starter, an umpire at the finish, and timekeepers. They shall not be bound to select such officers from among their own number.

The commission is charged with the duty of enforcing strictly these rules and of passing upon and deciding all incidents which may occur. The race shall be confirmed by this commission.

XI. The race shall be held on the road, in a single stage, of a distance not less than 550 kilometers, and not more than 650 kilometers. This distance may be taken from one city to another, or may be divided into several round trips, each partial trip to be not less than 125 kilometers.

The Holding Club shall choose the route; it shall make the same known in

an exact and detailed manner by registered mail to the Challenging Clubs at least three months before the date fixed for the race.

If, after such notification, a change of itinerary should be made, the same shall be communicated at once by registered mail to the competing clubs. No such change shall be permitted except in case of absolute necessity and only after receiving the approval of the commission provided for by Article X hereof.

XII. The race shall be run in the country where the cup is held. The Holding Club, however, shall always have the right to run the race in France.

XIII. Starting shall be at intervals of two minutes. The order shall be as follows: First a carriage of the team of the Holding Club; then a carriage of each of the teams of the contesting clubs, beginning with the club whose challenge was first received; then the second carriage of the Holding Club, followed in the same order by the second carriages of the other clubs. Finally the third carriages in the same order.

XIV. The carriage which shall cover the distance in the shortest time shall be declared the winner, and shall win the

cup for its club, even though it be the only one of its team to finish the course.

XV. In case of a dead-heat between the Holding Club and one of the Challenging Clubs, the Holding Club shall keep the cup.

XVI. In case of a dead-heat between two challenging clubs for the first place, they shall race over again, under these rules, within a period of two months, it being understood that the end of such period may be later than provided for by Article V hereof.

In case the two clubs should not be able to agree for the choice of route, they shall draw lots.

Should one of the clubs refuse to run again, the other club shall ipso facto become the holder of the cup.

XVII. Within fifteen days after the confirmation of the race, the cup shall be handed over to the custody of the winner. In case of a dead-heat and pending the running off of the same, the cup shall remain in the custody of the Holding Club.

XVIII. If one of the challenging clubs should be alone represented at the start, it shall cover the whole course within a maximum time to be fixed by

the commission provided for by Article X hereof. A failure to do so shall entitle the Holding Club to keep the cup.

XIX. It is well understood that no club shall ever become the owner of the cup; it may only be the holder thereof, subject to these rules.

XX. In case the Holding Club should cease to exist, the cup shall be handed over to Mr. Gordon Bennett, or in his default, to the Automobile Club of France.

XXI. The races for the cup, whether they take place in France or in another country, shall always be subject to the Racing Rules of the Automobile Club of France.

XXII. The expenses for the transportation of the carriages and of their equipments, for combustibles, etc., shall be borne by the owners of the vehicles or by the clubs which they represent.

XXIII. The traveling expenses of the members of the commission provided for by Article X hereof shall be borne by the clubs which they represent.

The expenses for the organization of the race itself (compensation and traveling expenses of timekeepers, posters, tips along the course, etc.) shall be disbursed

by the Holding Club. After the race they shall be divided equally between the Holding Club and the challenging clubs. It is agreed that the sums due from the challenging clubs which do not take part in the race (and which thereby have forfeited to the Holding Club the Three Thousand Francs named in Article III hereof) shall be paid by the Holding Club.

XXIV. All clubs whether holding the cup or challenging for it, thereby agree absolutely to conform strictly to all articles of these rules and in cases not herein provided for, to conform to all the articles of the Road Racing Rules of the Automobile Club of France.

THE VANDERBILT CUP RULES.

First. The cup shall be known as "The William K. Vanderbilt, Jr. Cup."

Second. The cup is to be competed for annually through the American Automobile Association or its successor.

Third. The distance of the race is to be not less than 250 miles nor more than 300 miles. The course must be over a regularly used highway and the competition is under no circumstances to be held on a track.

Fourth. Challenges must be filed before March 15 of each year, entries closing on that date. No postponements on account of weather conditions to take place after the date of the race has been settled on by mutual agreement between the holding and the challenging club.

Fifth. Competition shall be allowed only to clubs that are recognized by or affiliated with the American Automobile Association, and to clubs recognized by or affiliated with the Automobile Club of France.

Sixth. Not more than ten cars shall represent any one country.

Seventh. During 1904 and 1905, the first two years after the establishment of the race, the contest must be held in the United States. Subsequent to 1905 contests may be held within the country holding the cup.

Eight. Challenge fees must be accompanied by a fee of $500 for each car entered. In the event of non-appearance, or failure to start, the entire fee of $500 shall be forfeited to the holding club.

Ninth. The annual contests are to be governed by the Road Racing Rules of the American Automobile Association (when held in the United States) and the Road Racing Rules of the Automobile Club of France (when held within a foreign country).

Tenth. Each contestant, when challenging, assumes (a) all expenses incidental to his participation and (b) all liability for criminal or civil suits for damages caused by him.

Eleventh. When the contest is held within the United States, the American Automobile Association shall:

1. Select and name the course to be covered.

2. Secure the necessary legislation or local government consent.

3. Assume all expenses incidental to the above, and of all officials, control stations, marking the course, etc., and take in return all forfeited fees and such portion of the entrance fee as is not already provided for.

4. Name the first, second, third and each succeeding car in the order of finishing, together with their times.

5. Have the course thoroughly policed, turns suitably indicated and danger points warned.

6. Appoint all officials with their credentials.

7. Control all neutral zones.

Twelfth. When the contest is held within a foreign country, the Automobile Club of France shall be charged with the foregoing duties.

Thirteenth. Turns shall be indicated as follows:

Right. Red banner, right side of road, hundred yards before turn is reached. A second red banner on near right side of corner.

Left. Same as above, except that banners should be blue.

Fourteenth. Straight-ahead intersections should be marked with white banners placed as above.

Straight-ahead junctions: two white banners placed as above.

Railroad crossings: Green banner placed one hundred yards before.

Sharp or dangerous declines: Yellow banner one hundred yards before.

Fifteenth. Neutral zones are to be indicated by black streamers stretched across highways from a fixed point with the number of the zone indicated by white letters; streamers to be three feet by ten feet; letters at least 18 inches high by 6 inches wide. Inscription to read "Neutral."

Sixteenth. Controls shall be indicated by white streamers, similarly placed, of like dimensions, with the word "Control" and the number of said control consecutively arranged in black; all letters and figures to be not less than six inches in width and eighteen inches in height.

Seventeenth. All contests shall be governed by a commission composed of the following: The racing board of the American Automobile Association, the donor of the cup, Mr. William K. Vanderbilt, Jr., and one member of the Auto-

mobile Club of France, to be named by the president of the A. C. F. This commission to serve whenever the contest takes place in the United States. During such years when the contest is held on foreign soil the commission shall be composed as follows: The donor, Mr. William K. Vanderbilt, Jr., one member of the racing board of the American Automobile Association and the sports committee (or racing committee) of the Automobile Club of France.

Eighteenth. Competing cars must carry a distinguishing number arranged consecutively and drawn by lot after the date of the closing of entries. The number so drawn shall indicate the order of starting.

Nineteenth. There shall be no restriction as to the weight of competing cars, except that they must weigh between 881 and 2,204 pounds and carry two passengers, seated side by side, whose weight must be at least 132 pounds each.

Twentieth. Cars must be weighed in by official weighers on the day preceding the race and equipment noted for checking when appearing at the starting line.

Twenty-first. Cars must start in the order of drawing at intervals of 60 sec-

onds. Time of each car to be taken at the time fixed for its departure. Failure of the car to be present at that moment will cause it to lose as much time as elapses from the time of the given start until the moment it crosses the line.

Twenty-second. During the contests of 1904 and 1905 the first car will be started at daylight or as soon after as the commission deem it safe.

THE CHARLES J. GLIDDEN TOURING TROPHY—ARTICLES OF DEED OF GIFT.

First. The trophy shall be known as "The Charles J. Glidden Touring Trophy."

Second. The cup shall be competed for annually, beginning with the year 1905, by members of any American automobile club affiliated with the American Automobile Association, or of any club in the world recognized by it. The club of which the winner is a member shall have the custody of the trophy until it is won by another, and shall give to the American Automobile Association, or its successor, a satisfactory bond, with sureties, in the sum of three thousand ($3,000.00) dollars for such custody.

Third. The distance to be driven in competition shall not be less than one thousand miles, nor less than five hundred miles weekly, and shall be over regularly used highways in the country where the holding club is located, except in the years 1905, 1906 and 1907, when the contest shall be held in either the United States or Canada, or both.

Fourth. Each 1905 entry must be accompanied by a fee of $50.00. In event of failure to start, the entry fee shall be forfeited.

Fifth. The car shall be driven by the owner or a driver approved by the committee, the owner being a passenger in the car.

Sixth. All other rules governing the contest shall be fixed by a committee of seven, consisting of the president of the American Automobile Association (who shall be chairman), the donor, and the presidents of the Automobile Club of America, the Automobile Club of Great Britain and Ireland, the Automobile Club of France, the Deutscher Automobil Club, and the president of an automobile club in Canada to be recognized by the American Automobile Association, or representatives selected by the above-named persons. The chairman and two members of the committee shall constitute a quorum.

FRONTIER REGULATIONS FOR FOREIGN AUTOMOBILE TRAVEL.

AUSTRIA-HUNGARY.

The duty on automobiles and motor cycles must be deposited and a receipt taken at the time they enter the country. The money will be repaid to the traveler on his recrossing the frontier with the machine if the receipt is presented to the customs authorities. The receipt is valid for two months and may in certain cases be extended, but not beyond December 31. of the year of issue.

BELGIUM.

The duty is 12 per cent. ad valorem, paid on entry; a receipt valid for a year is given and money returned on re-exportation.

CANADA.

The duty is 35 per cent. ad valorem. For temporary importation of an automobile, a bond for twice the amount of duty and a cash deposit of $25.00 is exacted. These are released, against sur-

render of certificate, on taking the car out of Canada.

DENMARK.

No duty is collected on automobiles for traveling purposes and as a means of transportation. A simple declaration of the traveler that the entry is temporary is sufficient.

ENGLAND.

Automobiles in condition for use are duty free. There are no special requirments.

FRANCE.

On entry of automobiles into France a guaranty must be deposited, viz., 50 francs ($9.65) for 100 kilograms (220 pounds) if the vehicle weighs more than 125 kilograms (275 pounds), and 120 francs ($23.16) if it weighs less than 125 kilograms. The customs receipt is good for six months, and the amount will be repaid to the traveler on his leaving the country.

GERMANY.

Automobiles and cycles are identified at the last custom-house before leaving

German soil, so that there may be no additional proceedings on their re-entering the country. On foreign automobiles the duty is 150 marks ($35.70) each. The automobile is provided with a lead seal. The amount will be repaid if the receipt is presented at the custom-house when the machine is taken out of the country.

GREECE.

Besides a non-returnable fee of a few drachmas (1 drachma—19.3 cents) the duty on automobiles is calculated according to a special tariff. When the vehicle leaves the country the duty is repaid, but 5 drachmas (97 cents) for expenses and an additional payment are deducted if it does not repass the same custom-house as on entering.

ITALY.

Automobiles weighing up to 500 kilograms pay a duty of 200 francs; to 1,000 kilograms, 400 francs; and over 1,000 kilograms, 600 francs. The deposit receipt is valid for six months, but the period may be extended to one year through a written application made before expiration of the six months. The

money will be refunded to the traveler on leaving the country.

LUXEMBOURG.

Automobiles are duty free if in condition for use on entering from Germany, as Luxembourg belongs to the German Customs Union. Otherwise the duty is 150 marks ($35.70). The duty will be refunded when the traveler leaves the country on condition that he has given a notice containing a description of the automobile and place of entering and leaving the country to the custom-house in Luxembourg ten days before his entry.

MEXICO.

Duty on automobiles is computed by weight. First 250 kilograms net pay 60 cents; 250—750 kilograms 50 cents; and over 750 kilograms, 40 cents per kilogram. A cash deposit for amount of duty is probably accepted from tourists and returned against surrender of certificate when leaving the country.

NETHERLANDS.

Automobiles are free of duty if used for traveling, but the frontier customs

official has discretionary authority, as a matter of precaution, to demand a deposit, which may not exceed 5 per cent. of the value. The receipt is valid for one year, and the duty will be refunded on presentation to any frontier customs official by the traveler on recrossing the border with the vehicle.

NORWAY.

Automobiles are free of duty as a means of traveling. The traveler must make written declaration that the vehicle is for the purpose of travel and is being entered for temporary sojourn only.

PORTUGAL.

Duties are established for particular cases. Deposit will be refunded when machine is taken from the country. Notice by letter or telegram should be given to the frontier customs official concerned.

ROUMANIA.

Duties on vehicles are according to a special tariff. Deposit will be refunded

when machine is taken from the country. Previous notice is advisable.

RUSSIA.

Vehicles can cross the frontier only by special permission of the minister of finance obtained by written request. The duty for a two-seated vehicle is 90 rubles ($46.35) in gold and 20 per cent. extra for coach and trimmings; for a four-seated or larger vehicle the duty is 132 rubles ($67.98) in gold and 20 per cent. extra. Duty on the motor is additional, according to a special tariff. There are many requirments to be fulfilled. Duty will be refunded to traveler in two to ten months, when he leaves the country with the machine.

SPAIN.

A duty of 18.50 pesetas ($3.57) is levied per 100 kilograms (220 pounds) for motors, and for vehicles according to form, varying from 350 pesetas ($67.55) to 1,000 pesetas ($193). The deposit receipt must be duly confirmed by the frontier customs official where machine is taken out of the country before presen-

tation at the custom-house first passed on entering the country in order to have deposit refunded.

SWEDEN.

A duty of 15 per cent. of the value of the vehicle is required to be deposited, to be refunded when the machine is taken out of the country. Under some circumstances expenses may amount to 5.5 crowns ($1.47).

SWITZERLAND.

A free passport of admission for six months is granted for automobiles with lead seal attached. Otherwise the rates of duty are 20 francs ($3.86) for 100 kilograms (220 pounds) and 4 francs (77 cents) for 100 kilograms of the motor.

TURKEY.

A duty of 8 per cent. is collected on vehicles. Two per cent. will be refunded to traveler when his machine is taken out of the country. An excessively high assessment should be guarded against.

It is sometimes necessary, and always

advisable, to have an authentic description of the automobile, weight, number, etc., signed or stamped by the manufacturer, to be presented at the frontier or elsewhere. Previous notice to customs officials as to entering or leaving a country will be the means of facilitating matters in many cases.

RACE STATISTICS

Short records of the winners in the prominent International race events.

GORDON-BENNETT

Year	Distance Km.	Winner	Car	Country	Course	Average Per Hour, Km.	Time elapsed
1900	566	Charron	Panhard	France	Paris-Lyons	61.99	9.9
1901	565	Girardot	Panhard	France	Paris-Bordeaux	59.42	8.51.50
1902	623	Edge	Napier	England	Paris-Innsbruck	55.23	11.2.54
1903	593	Jenatzy	Mercedes	Germany	Ireland	79.30	6.39
1904	565	Thery	Richard-Brasier	France	Taunus, G'y	96.89	5.50.3
1905	550	Thery	Richard-Brasier	France	Auvergne	77.40	7.2.42
1906							
1907							
1908							
1909							
1910							

VANDERBILT

Year	Distance miles	Winner	Car	Country	Course	Average Per Hour, miles.	Time elaps
1904	302.4	Heath	Panhard	France	Long Island		5.26.45
1905	283	Hemery	Darracq	France	Long Island	61.49	4.36.8
1906	297.1	Wagner	Darracq	France	Long Island	61.41	4.50.10 2/5
1907							
1908							
1909							
1910							

RACE STATISTICS

Short records of the winners in the prominent International race events.

FLORIO

Year	Distance miles	Winner	Car	Country	Course	Time
1905	312.3	Raggio	Itala	Italy	Brescia Circ.	4.46.47 2-5
1906	Not run on account of government's refusal to furnish troops for patroling course.					
1907						
1908						
1909						
1910						

GRAND PRIX

Year	Distance miles	Winner	Car	Country	Course	Time
1906	774	Szisz	Renault	France	Sarthe Circ.	12.14.5
1907						
1908						
1909						
1910						

RACE STATISTICS

Short records of the winners in the prominent International race events.

GLIDDEN TOUR

Year	Distance miles	Winner	Car	Country	Course
1905	approx. 1000	Pierce	Pierce Arrow	America	New York—Bretton Woods and back.
1906	approx. 1000	Pierce	Pierce Arrow	America	Buffalo—Bretton Woods and back.
1907					
1908					
1909					
1910					

HERKOMER TOUR

Year	Distance miles	Winner	Car	Country	Course
1905	580	Ladenburg	Mercedes	Germany	Bavarian circuit
1906		Stoess	Horch	Germany	Frankfort a/M-Vienna
1907					
1908					
1909					
1910					

RACE STATISTICS

Short records of the winners in the prominent International race events.

ORMONDE-DAYTONA BEACH RACES

Year	Distance	Driver	Car	Time
1903	1 Kilom.	Nestman	Stevens-Duryea	35 1-5s
1903	1 Mile	Nestman	Stevens-Duryea	‡57 1-5s
1904	1 Kilom.	Schmidt	40 Hp. Packard	29 2-5s
1904	1 Mile	Schmidt	40 Hp. Packard	46 2-5s
1905	1 Kilom.	McDonald	90 Hp. Napier	*23s
1905	1 Kilom.	Ross	20 Hp. Ross Steamer	‡24 1-5s
1905	1 Mile	McDonald	90 Hp. Napier	*34 2-5s
1905	1 Mile	Ross	20 Hp. Ross Steamer	‡38s
1905	5 Miles	McDonald	90 Hp. Napier	*3m17s
1905	10 Miles	McDonald	90 Hp. Napier	*6m15s
1905	20 Miles	E. R. Thomas	90 Hp. Mercedes	*13m24s
1905	30 Miles	E. R. Thomas	90 Hp. Mercedes	*20m37s
1905	40 Miles	Sartori	90 Hp. Fiat	*31m54 2-5s
1905	50 Miles	Fletcher	80 Hp. De Dietrich	*38m51s
1905	100 Miles	Fletcher	80 Hp. De Dietrich	*1h18m24s
1905	1 Kilom.	Bowden	120 Hp. Mercedes	†23 3-5s
1905	1 Mile	Bowden	120 Hp. Mercedes	†32 4-5s
1906	1 Kilom.	Marriott	50 Hp. Stanley Steamer	*18 2-5s
1906	1 Mile	Marriott	50 Hp. Stanley Steamer	*28 1-5s
1906	2 Miles	Demaugeaut	200 Hp. Darracq	*58 4-5s
1906	10 Miles	Lancia	110 Hp. Fiat	6m18 2-5s

RACE STATISTICS

Short records of the winners in the International race events.

ORMONDE-DAYTONA BEACH RACES—Continued.

Year	Distance	Driver	Car	Time
1906	15 Miles	Lancia	110 Hp. Fiat	10m
1906	30 Miles	Marriott	50 Hp. Stanley Steamer	**34m18 2-5s
1906	100 Miles	Earp	80 Hp. Napier	*1h15m40 2-5s
1907				
1907				
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RACE STATISTICS

Short records of the winners in the prominent International race events.

ORMONDE-DAYTONA BEACH RACES—Continued.

Year	Distance	Driver	Car	Time
1909				
1909				
1909				
1909				
1910				
1910				
1910				
1910				
1910				
1910				
1910				

*Accepted World's Record under rules.
†World's Record for unrestricted cars.
‡World's Record in its class.
**American championship.

TRACK AND ROAD RECORDS

1904 and 1905

Compiled by A. G. Batchelder, Secretary American Automobile Association

TRACK RECORDS

HEAVYWEIGHT (1,432 to 2,204 pounds) Gasoline Cars

Miles	Time	Driver	M. P.	Machine	Meet	Date
1	0.53	Oldfield	60	Peerless	Los Angeles	12-21-04
2	1:46 2-5	Oldfield	60	Peerless	Los Angeles	12-21-04
3	2:39 4-5	Oldfield	60	Peerless	Los Angeles	12-21-04
4	3:35	Oldfield	60	Peerless	Los Angeles	12-21-04
5	4:41	Chevrolet	90	FIAT	Empire City	6-26-05
6	5:22 2-5	Oldfield	60	Peerless	Los Angeles	12-21-04
7	6:15 4-5	Oldfield	60	Peerless	Los Angeles	12-21-04
8	7:09 1-5	Oldfield	60	Peerless	Los Angeles	12-21-04
9	8:04	Oldfield	60	Peerless	Los Angeles	12-21-04
10	9:12 3-5	Oldfield	60	Peerless	New York	10-29-04
15	14:03 3-5	Oldfield	60	Peerless	Fresno	12-13-04
20	18:45 2-5	Oldfield	60	Peerless	Denver	11- 5-04
25	23:38 3-5	Oldfield	60	Peerless	Fresno	12-13-04
30	28:38 2-5	Oldfield	60	Peerless	Fresno	12-13-04
35	33:35 4-5	Oldfield	60	Peerless	Fresno	12-13-04
40	38:31 4-5	Oldfield	60	Peerless	Fresno	12-13-04
45	43:30 1-5	Oldfield	60	Peerless	Fresno	12-13-04

TRACK RECORDS—Continued.

Miles	Time	Driver	M. P.	Machine	Meet	Date
50	48:40 1-5	Oldfield	60	Peerless	Fresno	12-13-04
60	1:08:12 2-5	Clemens	30	National	Indianapolis	11- 4-05
70	1:19:33 2-5	Clemens	30	National	Indianapolis	11- 4-05
80	1:30:46 1-5	Clemens	30	National	Indianapolis	11- 4-05
90	1:42:14	Clemens	30	National	Indianapolis	11- 4-05
100	1:53:21 4-5	Clemens	30	National	Indianapolis	11- 4-05
200	4:03:56	Vaughan	40	Decauville	Empire City	6-24-05
300	5:58:52	Vaughan	40	Decauville	Empire City	6-24-05
400	8:20:09	Vaughan	40	Decauville	Empire City	6-24-05
500	10:24:42	Vaughan	40	Decauville	Empire City	6-24-05
600	12:49:07	Vaughan	40	Decauville	Empire City	6-24-05
700	15:10:29 3-5	Clemens-Merz	30	National	Indianapolis	11-17-05
800	17:17:26 1-5	Clemens-Merz	30	National	Indianapolis	11-17-05
900	19:44:48 1-5	Clemens-Merz	30	National	Indianapolis	11-17-05
1000	21:58:00 4-5	Clemens-Merz	30	National	Indianapolis	11-17-05
1094 3-16	24 hours	Clemens-Merz	30	National	Indianapolis	11-17-05

MIDDLEWEIGHT (881 to 1,432 pounds) Gasoline Cars.

Miles	Time	Driver	M. P.	Machine	Meet	Date
1	0:58 4-5	Wurgis	32	Reo	Syracuse	9-13-05
2	2:02	Fisher	30	Premier	Chicago	10- 1-04
3	3:02	Tracy	30	Renault	Empire City	9-24-04
4	4:01 3-5	Tracy	30	Renault	Empire City	9-24-04
5	5:00	Vaughan	40	Decauville	Syracuse	9-18-05
10	10:01 2-5	Tracy	30	Renault	Empire City	9-20-04

LIGHTWEIGHT (551 to 881 pounds) Gasoline Cars.

Miles	Time	Driver	M. P.	Machine	Meet	Date
1	*0.55	Kulick	20	Ford	Empire City	11- 8-04
2	1:54	Kulick	20	Ford	Empire City	11- 8-04
3	2:51	Kulick	20	Ford	Empire City	11- 8-04
4	3:48 2-5	Kulick	20	Ford	Empire City	10-29-04
5	4:43 3-5	Kulick	20	Ford	Empire City	10-29-04

*Intermediate mile.

STEAM—(All Weights)

Miles	Time	Driver	M. P.	Machine	Power	Date
1	*0:57 4-5	Ross	20	Stanley	Providence	9-10-04
2	2:05 3-5	Ross	20	Stanley	Providence	9-10-04
3	3:05 3-5	Ross	20	Stanley	Providence	9-10-04
4	4:05 4-5	Ross	20	Stanley	Providence	9-10-04
5	4:58	Webb Jay	20	White	Empire City	6-25-05
10	10:22 1-5	Webb Jay	20	White	Harlem Track	5-27-05

*Intermediate mile of another race.

MORRIS PARK SPECIAL TRACK—ARC OF CIRCLE.
(Track 1.39 Miles per Lap.)

Miles	Time	Driver	M. P.	Machine	Power	Date
1	:48 4-5	Webb Jay	20	White	Steam	7- 4-05
1	:52 1-5	Chevrolet	90	FIAT	Gasoline	6-10-05
	:52 1-5	Christie	120	Christie	Gasoline	7- 3-05

STRAIGHTAWAY RECORDS

Free for all—Gasoline

Distance	Time	Driver	M. P.	Machine	Meet	Date
1 mile	:21 4-5	Bowden	120	Darracq	Ostend, France	11-14-04
1 kilo	*0:32 2-5	Baras	20	Mercedes	Ormond, Fla.	1-31-05
1	0:34 2-5	MacDonald	90	Napier	Ormond, Fla.	1-25-05
5	3:17	MacDonald	90	Napier	Ormond, Fla.	1-24-05
10	6:15	MacDonald	90	Napier	Ormond, Fla.	1-31-05
20	13:24	Thomas	90	Mercedes	Ormond, Fla.	1-31-05
30	20:37	Thomas	90	Mercedes	Ormond, Fla.	1-31-05
40	31:54 2-5	Sartori	90	FIAT	Ormond, Fla.	1-31-05
50	38:51	Fletcher	80	De Dietrich	Ormond, Fla.	1-31-05
100	1:18:24	Fletcher	80	De Dietrich	Ormond, Fla.	1-30-05

*This record was made by a car which is over the weight limit.

Free for all—Steam

Distance	Time	Driver	M. P.	Machine	Meet	Date
1 kilo	0:24 1-5	Ross	20	Stanley	Ormond, Fla.	1-26-05
1 mile	0:38	Ross	20	Stanley	Ormond, Fla.	1-25-05

CLUBS AFFILIATED WITH THE AMERICAN AUTOMOBILE ASSOCIATION

American Automobile Association, Headquarters Metropolitan Bldg., New York.

Albany Automobile Club	Albany, N. Y.
Auburn Automobile Club	Auburn, N. Y.
Automobile Club of America	New York.
Automobile Club of Buffalo	Buffalo, N. Y.
Automobile Club of Cincinnati	Cincinnati, O.
Automobile Club of New Jersey	Newark, N. J.
Automobile Club of New Orleans	New Orleans, La.
Automobile Club of Philadelphia	Philadelphia, Pa.
Automobile Club of St. Louis	St. Louis, Mo.
Automobile Club of So. California	Los Angeles, Cal.
Automobile Club of Springfield	Springfield, Mass.
Automobile Club of Troy	Troy, N. Y.
Automobile Club of Utica	Utica, N. Y.
Berkshire Automobile Club	Pittsfield, Mass.
Binghampton Automobile Club	Binghampton, N. Y.
Brockton Automobile Club	Brockton, Mass.
Chenango County Automobile Club	Norwich, N. Y.
Chicago Automobile Club	Chicago.
Cleveland Automobile Club	Cleveland, O.
Columbus Automobile Club	Columbus, O.

CLUBS—Continued.

Dallas Automobile Club	Dallas, Tex.
Empire City Trotting Club	New York.
Florida East Coast Autom. Assoc.	Daytona, Fla.
Geneva Automobile Club	Geneva, N. Y.
Grand Rapids Automobile Club	Grand Rapids, Mich.
Hartford Automobile Club	Hartford, Conn.
Houston Automobile Club	Houston, Tex.
Kankakee Automobile Club	Kankakee, Ill.
Long Island Automobile Club	Brooklyn, N. Y.
Martinsburg Automobile Club	Martinsburg, W. Va.
Massachusetts Automobile Club	Boston, Mass.
Motor Club of Detroit	Detroit, Mich.
Newton Automobile Club	Newton, Mass.
Pittsburg Automobile Club	Pittsburg, Pa.
Rhode Island Automobile Club	Providence, R. I.
Rochester Automobile Club	Rochester, N. Y.
Stamford Automobile Club	Stamford, Conn.
Syracuse Automobile Club	Syracuse, N. Y.
Virginia East Coast Autom. Assoc.	Norfolk, Va.
Wachusetts Automobile Club	Gardner, Mass.
Washington Autom. Dealers Assoc.	Washington, D. C.
Worcester Automobile Club	Worcester, Mass.

Additions since 1906.

FOREIGN NATIONAL AUTOMOBILE ORGANIZATIONS

EUROPE

Austria-Hungary	Oesterr. Automobil Club	Vienna
	Ungarischer Automobil Club	Budapest
Belgium	Automobile Club de Belge	Brussels
Denmark	Dansk Automobil Club	Copenhagen
England	Autom. Club of Great Britain & Ireland	London
	Motor Union of Gr. Britain & Ireland	London
	Irish Automobile Club	Dublin
	Scottish Automobile Club	Glasgow
France	Automobile Club de France	Paris
Germany	Kaiserl. Deutscher Autom. Club	Berlin
Holland	Automobile Club of Holland	The Hague
Italy	Club Automobili d'Italia	Milan

Portugal	Automobile Club of Portugal	Lisbon
Russia	Automobile Club of Russia	St. Petersburg
Spain	Royal Automobile Club of Spain	Madrid
Switzerland	Automobile Club of Switzerland	Geneva
	AFRICA	
Algeria	Automobile Club of Algiers	Algiers
So. Africa	Automobile Club of So. Africa	Cape Town
	ASIA	
India	Motor Union of West. India	Bombay
Straits Settl.	Feder. Malay States Autom. Club	Penang
	AUSTRALIA	
New Zealand	Auckland Autom. Association	Auckland
Victoria	Automobile Club of Victoria	Melbourne
	SOUTH AMERICA	
Argentine	Automobile Club of Argentina	Buenos Ayres

Additional Organizations since 1906.

LIST OF AMERICAN PLEASURE CARS AND FOREIGN CARS REPRESENTED IN AMERICA.

Name	Type	Cooling	Manufactured or sold by	At
Acme	Gasoline	Water	Acme Motor Car Co.	Reading, Pa.
Adams-Farwell	Gasoline	Air	Adams Company	Dubuque, Ia.
Aero Car	Gasoline	Air	Aerocar Comp.	Detroit, Mich.
Amer. Mercedes	Gasoline	Water	Daimler Mfg. Co.	Long Island City., N. Y.
Apperson	Gasoline	Water	Apperson Bros. Autom. Co.	Kokomo, Ind.
Apollo	Gasoline	Water	Chic. Record. Scale. Co.	Waukegan, Ill.
Ardsley	Gasoline	Water	Ardsley Motor Car Co.	Yonkers, N. Y.
Aster (fgn.)	Gasoline	Water	Aster Co., Agts.	New York.
Auburn	Gasoline	Water	Auburn Autom. Co.	Auburn, Ind.
Austin	Gasoline	Water	Austin Autom. Co.	Gr. Rapids, Mich.
Autocar	Gasoline	Water	Autocar Co.	Ardsmore, Pa.
Babcock	Electr.	.....	Baker Motor Vehicle Co.	Cleveland, O.
Baker	Electr.	.....	Babcock Electr. Carr. Co.	Buffalo, N. Y.
Berkshire	Gasoline	Water	Berkshire Autom. Co.	Pittsfield, Mass.
Berliet (fgn.)	Gasoline	Water	Mendel, Dale & Co., Agts.	New York.
Buffalo	Electr.	.....	Buffalo Elect. Carr. Co.	Buffalo,N. Y.
Buick	Gasoline	Water	Buick Motor Co.	Jackson, Mich.
Cadillac	Gasoline	Water	Cadillac Motor Car Co.	Detroit, Mich.
Cannon	Gasoline	Water	Burtt Mfg. Co.	Kalamazoo, Mich.
Cantono	Electr.	.....	Cantono Electr. Tractor Co.	New York.
C. G. V. (fgn.)	Gasoline	Water	Em. Voigt, Agt.	New York.
Chadwick	Gasoline	Water	Fairmount Eng. Works.	Philadelphia, Pa.

Name	Type	Cooling	Manufactured or Sold by	At
Chicago	Steam	Condens.	Chic. Autom. Mfg. Co.	Chicago.
Christie	Gasoline	Water	Christie Dir. Act. Mot. Car Co.	New York.
Clement-Bayard (fgn.)	Gasoline	Water	S. B. Bowman Autom. Co., Agt.	New York.
Cleveland	Gasoline	Water	Cleveland Motor Co.	Cleveland, O.
Columbia	Gasoline	Water	Electric Veh. Co.	Hartford, Conn.
Columbia	Electr.	.....	Electric Veh. Co.	Hartford, Conn.
Columbus	Electr.	.....	Columbus Buggy Co.	Columbus, O.
Compound	Gasoline	Water	E. H. V. Company.	Middleton, Conn.
Corbin	Gasoline	Air	Corbin Mot. Veh. Co.	New Brittain, Conn.
Corwin	Gasoline	Water	Corwin Mfg. Co.	Peabody, Mass.
Crawford	Gasoline	Water	Crawford Autom. Co.	Hagerstown, Md.
Darracq (fgn.)	Gasoline	Water	F. A. La Roche Co., Agts.	New York.
Decauville (fgn.)	Gasoline	Water	Decauv. Autom. Co., Agts.	New York.
De Dietrich (fgn.)	Gasoline	Water	De Dietrich Imp. Co., Agts.	New York.
Delaunay-Belville (fgn.)	Gasoline	Water	Palais de L'Automobile, Agts.	New York.
Dolson	Gasoline	Water	Dolson Autom. Co.	Charlotte, Mich.
Dorris	Gasoline	Water	Dorris Mot. Car Co.	St. Louis.
Duquesne	Gasoline	Air	Duquesne Constr. Co.	Jamestown, N. Y.
Duryea	Gasoline	Water	Duryea Power Co.	Reading, Pa.
Elmore	Gasoline	Water	Elmore Mfg. Co.	Clyde, O.
Engl. Daimler (fgn.)	Gasoline	Water	English Daimler Co., Agts.	New York.
Fiat (fgn.)	Gasoline	Water	Hol-Tan Co., Agts.	New York.
Ford	Gasoline	Water	Ford Motor Co.	Detroit, Mich.
Franklin	Gasoline	Air	H. H. Franklin Mfg. Co.	Syracuse, N. Y.
Frayer-Miller	Gasoline	Air	Oscar Lear Autom. Co.	Columbus, O.

Name	Type	Cooling	Manufactured or Sold by	At
Gale	Gasoline	Water	Western Tool Works.	Galesburg, Ill.
Gallia	El. Comp.	.....	Gallia Electr. Carriages.	New York.
Glide	Gasoline	Water	Bartholomew. Co.	Peoria, Ill.
Grout	Gasoline	Water	Grout Bros. Autom. Co.	Orange, Mass.
Harrison	Gasoline	Water	Harrison Wagon Co.	Grand Rapids, Mich.
Haynes	Gasoline	Water	Haynes Autom. Co.	Kokomo, Ind.
Holsman	Gasoline	Air	Holsman Autom. Co.	Chicago.
Hotchkiss (fgn.)	Gasoline	Water	Archer & Co., Agts.	New York.
Iroquois	Gasoline	Water	Iroquois Motor Car Co.	Seneca Falls, N. Y.
Jackson	Gasoline	Water	Jackson Autom. Co.	Jackson, Mich.
Jones-Corbin	Gasoline	Water	Jones-Corbin Motor Co.	Philadelphia, Pa.
Knox	Gasoline	Air	Knox Autom. Co.	Springfield, Mass.
Lambert	Gasoline	Water	Buckeye Mfg. Co.	Anderson, Ind.
Leon Bollee (fgn.)	Gasoline	Water	Cryder & Co., Agts.	New York.
Locomobile	Gasoline	Water	Locom. Co., of America.	Bridgeport, Conn.
Logan	Gasoline	Water	Logan Construct. Co.	Chillicothe, O.
Lozier	Gasoline	Water	Lozier Motor Co.	New York.
Marion	Gasoline	Air	Marion Motor Car Co.	Indianapolis, Ind.
Marmon	Gasoline	Air	Nordyke & Marmon Co.	Indianapolis, Ind.
Martini (fgn.)	Gasoline	Water	Palmer & Christie Agts.	New York.
Matheson	Gasoline	Water	Matheson Motor Car Co.	Wilkesbarre, Pa.
Maxwell	Gasoline	Water	Maxwell-Briscoe Motor Co.	Tarrytown, N. Y.
Mercedes (fgn.)	Gasoline	Water	Smith & Mabley, Agts.	New York.
Michigan	Gasoline	Water	Mich. Autom. Co., Ld.	Kalamazoo, Mich.
Mitchell	Gasoline	Water	Mitchell Motor Car Co.	Racine Junct., Wis.

Name	Type	Cooling	Manufactured or Sold by	At
Model	Gasoline	Water	Model Gas Eng. Works.	Auburn, Ind.
Moline	Gasoline	Water	Moline Autom. Co.	E. Moline, Ill.
Monarch	Gasoline	Water	Monarch Auto. Co.	Aurora, Ill.
Moon	Gasoline	Water	Moon Motor Car Co.	St. Louis, Mo.
Moore	Gasoline	Water	Moore Autom. Co.	New York.
Mora	Gasoline	Water	Mora Motor Car Co.	Rochester, N. Y.
Mors (fgn.)	Gasoline	Water	Mors Autom. Co., Agts.	New York.
Napier (fgn.)	Gasoline	Water	Napier Mot. Co., Of Amer.	Boston, Mass.
National	Gasoline	Water	National Mot. Veh. Co.	Indianapolis, Ind.
Northern	Gasoline	Water	Northern Mfg. Co.	Detroit, Mich.
Oldsmobile	Gasoline	Water	Olds Motor Works.	Lansing, Mich.
Orient	Gasoline	Air	Waltham Mfg. Co.	Waltham, Mass.
Oxford	Gasoline	Water	Detroit-Oxford Mfg. Co.	Oxford, Mich.
Packard	Gasoline	Water	Packard Motor Car Co.	Detroit, Mich.
Panhard (fgn.)	Gasoline	Water	Smith & Mabley, Agts.	New York.
Parsons	Electr.	.....	Parsons Electr. Motor Carr. Co.	Cleveland, O.
Peerless	Gasoline	Water	Peerless Motor Car Co.	Cleveland, Mich.
Pierce	Gasoline	Water	Geo. N. Pierce Co.	Buffalo, N. Y.
Pierce-Racine	Gasoline	Water	Pierce Engine Co.	Racine Junct., Wisc.
Pipe (fgn.)	Gasoline	Water	Jos. S. Heller, Agt.	New York.
Pope-Hartford	Gasoline	Water	Pope Mfg. Co.	Hartford, Conn.
Pope-Toledo	Gasoline	Water	Pope Motor Car Co.	Toledo, O.
Pope-Waverley	Electr.	.....	Pope Motor Car Co.	Indianapolis, Ind.
Premier	Gasoline	Air	Premier Motor Mfg. Co.	Indianapolis, Ind.
Pungs-Finch	Gasoline	Water	Pungs-Finch Autom. Co.	Detroit, Mich.

Name	Type	Cooling	Manufactured or Sold by	At
Queen	Gasoline	Water	C. H. Blomstrom Motor Co.	Detroit, Mich.
Rainier	Gasoline	Water	Rainier Autom. Co.	New York.
Rambler	Gasoline	Water	Thos. B. Jeffery & Co.	Kenosha, Wisc.
Rauch & Lang	Electr.	.....	Rauch & Lang Carriage Co.	Cleveland, O.
Renault	Gasoline	Water	Renault Freres Agentcy	New York.
Reo	Gasoline	Water	Reo Motor Car Co.	Lansing, Mich.
Richard-Brasier (fgn)	Gasoline	Water	E. B. Gallaher, Agt.	New York.
Rochet-Schneider (fgn.)	Gasoline	Water	Auto Import. Co., Agts.	New York.
Royal Tourist	Gasoline	Water	Royal Motor Car Co.	Cleveland, O.
Schacht	Gasoline	Water	Schacht Mfg. Co.	Cincinnati, O.
Simplex	Gasoline	Water	Smith & Mabley.	New York.
Spyker (fgn.)	Gasoline	Water	Centr. Park Autom. Stor. Co. Agts.	New York.
Stanley	Electr.	.....	Stanley Motor Carr. Co.	Newton, Mass.
Stearns	Gasoline	Water	F. B. Stearns Co.	Cleveland, O.
Stevens-Duryea	Gasoline	Water	J. Stevens Arms & Tool Co.	Chicopee Falls, Mass.
St. Louis	Gasoline	Water	St. Louis Motor Car Co.	Peoria, Ill.
Stoddard-Dayton	Gasoline	Water	Dayton Motor Car Co.	Dayton, O.
Studebaker	Gasoline	Water	Studebaker Autom. Co.	South Bend, Ind.
Studebaker	Electr.	.....	Studebaker Autom. Co.	South Bend, Ind.
Sturtevant	Gasoline	Water	Sturtevant Mil Co.	Boston, Mass.
Thomas	Gasoline	Water	E. R. Thomas Motor Co.	Buffalo, N. Y.
Tincher	Gasoline	Water	Tincher Motor Car Co.	Chicago.
Twyford	Gasoline	Water	Twyford Motor Car Co.	Brookville, Pa.
Upton	Gasoline	Water	Lebanon Motor Works.	Lebanon, Pa.

Name	Type	Cooling	Manufactured or Sold by	At
Veh. Equip.	Electr.	.....	Vehicle Equip. Co.	Long Isl. City, N. Y.
Viqueot (fgn.)	Gasoline	Water	Viqueot Co., Agts.	New York.
Walker	Gasoline	Water	Walker Motor Car Co.	Detroit, Mich.
Wayne	Gasoline	Water	Wayne Autom. Co.	Detroit, Mich.
Welch	Gasoline	Water	Welch Motor Car Co.	Pontiac, Mich.
White	Steam	Condens.	White Sewing Mach. Co.	Cleveland, O.
Winton	Gasoline	Water	Winton Motor Carr. Co.	Cleveland, O.
Wolverine	Gasoline	Water	Wolverine Autom. Co.	Dundee, Mich.
Woods	Electr.	.....	Woods Motor Veh. Co.	Chicago.
Woods	Gasoline	Water	Woods Motor Veh. Co.	Chicago.
York	Gasoline	Water	York Autom. Co.	York, Pa.
Zent	Gasoline	Water	Zent Autom. Co.	Bellefontaine, O.
Züst (fgn.)	Gasoline	Water	R. Bertelli & Co., Agts.	New York.

LIST OF AMERICAN COMMERCIAL CARS

Name	Type	Cooling	Manufactured by	Factory
Atlas	Gasol.	Water	Knox Motor Truck Co.	Springfield, Mass.
Auto-Car	Gasol.	Water	Auto-Car Co.	Buffalo, N. Y.
Auto-Car	Electr.	.....	Auto-Car Co.	Buffalo, N. Y.
Cadillac	Gasol.	Water	Cadillac Motor Car Co.	Detroit, Mich.
Comm. Truck	Gasol.	Water	Comm. Motor Car Co.	New York.
Compound	Gasol.	Water	E. H. V. Company.	Middleton, Conn.
Duryea	Gasol.	Water	Duryea Power Co.	Reading, Pa.
Four Wheel-Drive	Gasol.	Water	Four Wheel Drive Wagon Co.	Milwaukee, Wisc.

Name	Type	Cooling	Manufactured or Sold by	At
Lansden	Electr.	.....	Lansden Company.	Newark, N. J.
Logan	Gasol.	Air	Logan Constr. Co.	Chillicothe, O.
Maxwell	Gasol.	Water	Maxwell-Briscoe Motor Co.	Tarrytown, N. Y.
Oldsmobile	Gasol.	.....	Olds Motor Works.	Lansing, Mich.
Packard	Gasol.	Water	Packard Motor Car Co.	Detroit, Mich.
Parsons	Electr.	Water	Parsons El. Mot. Carr. Co.	Cleveland, O.
Pope-Toledo	Gasol.	Water	Pope Motor Car Co.	Toledo, O.
Pope-Waverley	Electr.	.....	Pope Motor Car Co.	Indianapolis, Ind.
Rapid	Gasol.	Water	Rapid Motor Veh. Co.	Pontiac, Mich.
Reo	Gasol.	Water	Reo Motor Car Co.	Lansing, Mich.
Soules	Gasol.	Water	Soules Motor Car Co.	Gr. Rapids, Mich.
V. E. Co.	Electr.	.....	Veh. Equipm. Co.	L. Island C'y, N. Y.
Wolverine	Gasol.	Water	Wolverine Autom. Co.	Dundee, Mich.

LIST OF FOREIGN CARS

FRANCE

Ader	Chaboche	Delahaye	Georges Richard
Ariès	Chenard-Walker	Delaugere & Clayette	Gillet-Forest
Bailleau	Clement	Delaunay-Belleville	Gladiator
Barré	Clement-Bayard	De Dion-Bouton	Gobron-Brillié
Berliet	Cohendet	De Dietrich	Grégoire
Brouhot	Cottereau	Delta	Henriod
Bollee, Leon	Darracq	Gallia	Hotchkiss
C. G. V.	Decauville	Gardner-Serpollet	Krieger

Lambert, A.
Lambert, Prosper
Mildé
Morisse
Mors
Motobloc
Panhard-Levassor
Peugeot
Pilain
Radia
Regina-Dixi
René Legros
Renault
Richard-Brasier
Rochet-Schneider
Roy
Svelte
Tony Huber
Vulpes
Westinghouse

GREAT BRITAIN

Albion
Alldays
Argyll
Ariel
Arrol-Johnston
Belsize
Brooke
Brotherhood
Brown
Chenard & Walker
Clyde
Crossley
Dennis
English Daimler
Germain
Hallamshire
Humber
Hutton
James & Browne
Lacre
Lanchester
Maudsley
Napier
Orleans
Rolls-Royce
Royal Enfield
Ryknield
Siddeley
Simms
Singer
Speedwell
Star
Swift
Talbot
Thorneycroft
Turner-Miesse
Vauxhall
Vulcan
Whitlock-Aster
Wilson-Pilcher
Wolseley

GERMANY

Adler
Argus
Beckmann
Benz
Cuddell-Phoenix
Dixi
Duerkopp
Ehrhardt-Decauville
Electro-Cardinet
F. E. G.
Horch
Maurer-Union
Mercedes
N. A. G.
Opal-Darracq
Piccolo
Polymobil
Priamus
Protos
Rex-Simplex
Scheibler
Stoewer
Urbanus
Victoria

BELGIUM

Direct — La Metalurgique — Minerva — Pipe

ITALY

Fiat — Itala — Isotta Fraschini

SWITZERLAND

Excelsior — Martini

HOLLAND

Spyker

AUSTRIA

Lohner-Porsche

LIST OF AUTOMOBILE TIRE MAKERS

Name of Tire	Made or Sold by	At
Continental (fgn.)	Contin. Caoutchouc Co., Agts., 43 Warren St.	New York
Diamond	Diamond Rubber Co.	Akron, O.
Fawkes	Milwaukee Rubber Works Co.	Milwaukee, Wisc.
Firestone	Firestone Tire & Rubber Co.	Akron, O.
Fisk	Fisk Rubber Co.	Chicopee Falls, Mass.
G. & J.	G. & J. Tire Co.	Indianapolis, Ind.
Goodrich	B. F. Goodrich Co.	Akron, O.
Goodyear	Goodyear Tire & Rubber Co.	Akron, O.
Hartford	Hartford Rubber Works.	Hartford, Conn.
Michelin (fgn.)	Mich. Prod. Sell. Co., 31 W. 31st St., Agts.	New York.
Morgan & Wright	Morgan & Wright.	Chicago.
Pennsylvania-Clincher	Pennsylvania Rubber Co.	Jeanette, Pa.
Swinehart	Swineh. Clinch. Tire & Rubber Co.	Akron, O.

LIST OF AUTOMOBILE TRADE PAPERS.

AMERICAN

Automobile, Flatiron Bldg., New York—weekly.
Automobile Magazine, 136 Liberty St., New York—monthly.
Automobile Topics, Times Bldg., New York—weekly.
Cycle & Autom. Trade Journal, 1213 Filbert St., Philadelphia—monthly.
Horseless Age, 9-15 Murray St., New York—monthly.
Motor, 1789 Broadway, New York—monthly.
Motor Age, 309 Michigan Ave., Chicago—weekly.
Motor Field, 1748 Stout St., Denver, Col.—monthly.
Motor News, 90 Griswold St., Detroit, Mich.—monthly.
Motor Way, 315 Dearborn St., Chicago—weekly.
Motor World, 154 Nassau St., New York—weekly.
Tire and Motor, 35 W. 21. St., New York—monthly.

FOREIGN.

CANADA.

Canadian Motor, Toronto, Can.—monthly.

ENGLAND.

Autocar, 20 Tudor St., London—weekly.
Automobile Club Journal, 18 Down St., Picadilly, London—weekly.
Automobile Journal, 44 St. Martin's Lane, London—weekly.
Car, 17 Shaftesbury Ave., London—weekly.
Commercial Motor, 7-15 Roseberry Ave., London—weekly.
Industrial Motor Review, 89 Fleet St., London—weekly.
Motor, 7-15 Roseberry Ave., London—weekly.
Motor Car Journal, 27-33 Charing Cross Road, London—weekly.
Motor Car Magazine, 17 Shaftesbury Ave., London—monthly.
Motor News, 516 Birkbeck Bank Bldgs., London—weekly.
Motor Review, 27 Chancery Lane, London—monthly.
Motoring Illustrated, 9 Arundel St., Strand, London—weekly.
Motorist and Traveler, 12 Henrietta St., Covent Garden, London—weekly.
Motor World, 73 Dunlop St., Glasgow—weekly.
Motor Traction, 20 Tudor St., London—weekly.

FRANCE.

L'Automobile, 7 Rue St. Benoit, Paris—weekly.
La Vie Automobile, 49 Quai des Grandes Augustines, Paris—weekly.
L'Auto, 10 Rue du Faubourg Montmartre, Paris—daily.
La France Automobile, 68 Ave. de la Grande Armee, Paris—weekly.
La Locomotion Automobile, 15 Rue Bouchut, Paris—weekly.
Les Sports, 20 Rue St. Marc, Paris—daily.
Omnia, 20 Rue Duret, Paris—weekly.

GERMANY.

Allgemeine Automobil Zeitung, Kontorhaus, Muenchen—weekly.
Automobil Welt, Lindenstrasse 16-17, Berlin—weekly.
Der Motorwagen, Kurfuerstendamm 248, Berlin—semi-monthly.

BELGIUM.

L'Automobile Belge, 50 Rue Gretry, Brussels—weekly.

ITALY.

L'Automobile, 2 Via S. Simpliciano, Milan—weekly.

AUSTRIA.

Allgemeine Automobil Zeitung, 5 Fleischmarkt, Vienna—weekly.

AVERAGE SPEED TABLE.

Presenting the calculated speed per hour against the time occupied in running a mile.

M. S.—minutes & seconds; M. Y.—Miles & Yards.

M. S.	M. Y.	M. S.	M. Y.
5.0	12.0	1.18	46.271
4.50	12.728	1.16	47.648
4.40	12.1509	1.14	48.1142
4.30	13.587	1.12	50.0
4.20	13.1489	1.10	51.754
4.10	14.704	1.08	52.1656
4.0	15.0	1.06	54.960
3.50	15.1148	1.04	56.440
3.40	16.640	1.02	58.113
3.30	17.251	1.0	60.0
3.20	18.0	0.59	61.30
3.10	18.1667	0.58	62.121
3.0	20.0	0.57	63.278
2.50	21.312	0.56	64.503
2.40	22.880	0.55	65.8
2.30	24.0	0.54	66.1173
2.20	25.1257	0.53	67.1627
2.10	27.1218	0.52	69.406
2.0	30.0	0.51	70.1035
1.50	32.1280	0.50	72.0
1.48	33.587	0.49	73.826
1.46	33.1694	0.48	75.0
1.44	34.1083	0.47	76.1049
1.42	35.518	0.46	78.459
1.40	36.0	0.45	80.0
1.38	36.1298	0.44	81.1440
1.36	37.880	0.43	83.1678
1.34	38.524	0.42	85.1257
1.32	39.158	0.41	87.1270
1.30	40.0	0.40	90.0
1.28	40.1660	0.39	92.542
1.26	41.1514	0.38	94.1297
1.24	42.1509	0.37	97.523
1.22	43.1588	0.36	100.0
1.20	45.0	0.35	102.1508

METRIC WEIGHTS AND MEASURES.

Gram—15,432 grains.
Decagram (10 grains)—0.3527 oz.
Hectogram (100 grains)—3.5274 oz.
Kilogram (1,000 grains)—2.2046 lbs.
Quintal (100 kilo)—220.46 lbs.
Millier or tonneau (ton)—2204.6 lbs.

Dry Measures.

Liter—0.908 qt.
Decaliter (10 liter)—9.08 qts.
Hectoliter (100 liter)—2.838 bushels.

Liquid Measures.

Liter—1.0567 qts.
Decaliter (10 liter)—2.6418 gals.
Hectoliter (100 liter)—26.417 gals.

Measures of Length.

Millimeter—0.0394 in.
Centimeter—0.3937 in.
Decimeter—3.937 in.
Meter—39.37 in.
Decameter—393.7 in.
Hectometer—328' 1".
Kilometer—0.62137 miles (3280' 10".)

Surface Measures.

Centare (1 sq. m.) 1500 sq. in.
Are—(100 sq. m.)—119.6 sq. yards.
Hectare (10.000 sq. m.)—2.471 acres.

Comparative Table of Weights.

Lbs.	Kgs.	Lbs.	Kgs.
1	.452	100	45.25
2	.905	200	90.50
3	1.357	300	135.75
4	1.809	400	181.00
5	2.262	500	226.25
10	4.525	1000	452.50
15	6.787	2000	905.00
20	9.050	3000	1357.50
25	11.31	4000	1810.00
50	22.62	5000	2262.50

Kgs.	Lbs.	Kgs.	Lbs.
1	2.204	25	55.115
2	4.409	50	110.230
3	6.614	100	220.460
4	8.818	500	1102.300
5	11.023	1000	2204.600
10	23.046	2000	4409.200

COMPARATIVE TABLE OF LENGTHS.

Feet	Meters	Feet	Meters
1-12	2.54cm.	5	1.524
1-2	15.24cm.	10	3.048
1	30.48cm.	25	7.62
2	60.96cm.	50	15.24
3	91.44cm.	100	30.48
4	1.2192M.	1000	304.80

Meters	Feet	Meters	Feet
1	3.280	10	32.808
2	6.561	25	82.020
3	9.842	50	164.040
4	13.123	100	328.080
5	16.404	1000	3280.8693

Miles	Km.	Miles.	Km.
1	1.609	25	40.225
2	3.218	50	80.450
3	4.827	100	160.900
4	6.436	500	804.500
5	8.045	1000	1609.000
10	16.090	2000	3218.000

Km.	Miles	Km.	Miles.
1	0.621	25	15.525
2	1.242	50	31.050
3	1.863	100	62.100
4	2.484	500	310.500
5	3.105	1000	621.000
10	6.210	2000	1242.000

COMPARATIVE TABLE OF LIQUID MEASRUES.

Gal.	Liters.	Gal.	Liters.
1	3.7853	4	15.1412
2	7.5706	5	18.9265
3	11.3559	10	37.8531

Liters	Gal.	Liters	Gal.
1	0.2641	4	1.0567
2	0.5283	5	1.3208
3	0.7925	10	2.64117

COMPARATIVE TABLE OF SURFACE MEASURES

Sq. Fit.	Sq. M.	Sq. Ft.	Sq. M.
1	.0929	4	.3716
2	.1858	5	.4645
3	.2782	10	.9290
Sq. M.	**Sq. Ft.**	**Sq. M.**	**Sq. Ft.**
1	10.764	4	42.056
2	21.528	5	53.820
3	32.292	10	107.641

COMPARATIVE TABLE OF CUBIC MEASURES

Cu. Ft.	Cu. M.	Cu. Ft.	Cu. M.
1	.02831	5	.14158
2	.05663	10	.28316
3	.08494	50	1.41580
4	.11326	100	2.83161
Cu. M.	**Cu. Ft.**	**Cu. M.**	**Cu. Ft.**
1	35.31	5	176.57
2	70.63	10	353.15
3	105.94	50	1765.70
4	141.26	100	3531.50

FOREIGN CURRENCY VALUES

(Approximate)

Country	Standard	Unit	U. S. Value
Argentine	Gold	Peso	$0.965
Austria-Hungary	Gold	Krone	.203
Belgium	Gold	Franc	.193
Bolivia	Silver	Boliviano	.384
Brazil	Gold	Milreis	.546
Brit. Colonies in N. Amer. exc. N. F.	Gold	Dollar	1.000
Centr. Amer. States.			
Costa Rica.	Gold	Colon	.465
Guatemala	Silver	Peso	.384
Honduras.	Gold	Dollar	1.000
Honduras, Brit.	Silver	Peso	.384
Nicaragua	Silver	Peso	.384
Salvador	Silver	Peso	.384
Chile	Gold	Peso	.365
China			
Amoy	Silver	Tael	.622
Canton	Silver	Tael	.620
Chefoo	Silver	Tael	.595
Chin Kiang	Silver	Tael	.607
Fuchau	Silver	Tael	.575
Haikwan	Silver	Tael	.633
Hankow (Customs)	Silver	Tael	.582
Niuchwang (Customs)	Silver	Tael	.583
Ningpo (Customs)	Silver	Tael	.598
Shanghai (Customs)	Silver	Tael	.568
Swatow (Customs)	Silver	Tael	.575
Takau (Customs)	Silver	Tael	.626
Tientsin (Customs)	Silver	Tael	.603
Columbia	Silver	Peso	.384
Cuba	Gold	Peso	.384
Denmark	Gold	Kroner	.268
Ecuador	Gold	Sucre	.487
Egypt	Gold	Pound	4.943
Finland	Gold	Mark	.193
France	Gold	Franc	.193
Germany	Gold	Mark	.238
Great Britain	Gold	Pound Stlg.	4.866
Greece	Gold	Drachma	.193
Haiti	Gold	Gourde	.965
Holland	Gold	Florin	.402

Country	Standard	Unit	U. S. Value
India	Gold	Pound Stlg.	4.866
Italy	Gold	Lira	.193
Japan	Gold	Yen	.498
Liberia	Gold	Dollar	1.000
Mexico	Silver	Dollar	.418
N. Foundland	Gold	Dollar	1.014
Norway	Gold	Kroner	.268
Persia	Silver	Kran	.071
Peru	Gold	Sol	.487
Portugal	Gold	Milreis	1.080
Russia	Gold	Ruble	.515
Spain	Gold	Peseta	.193
Sweden	Gold	Kroner	.268
Switzerland	Gold	Franc	.193
Turkey	Gold	Piaster	.044
Uruguay	Gold	Peso	1.034
Venezuela	Gold	Bolivar	.093

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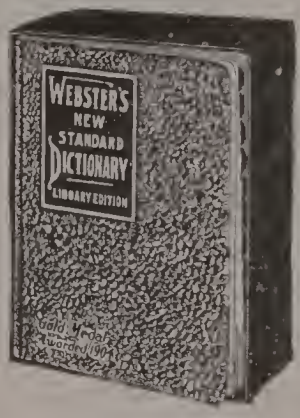

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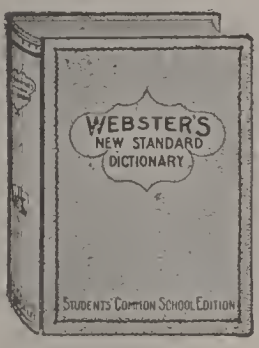

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